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ABSTRACT

This curriculum guide, one of six modules keyed to the building maintenance competency profile developed by industry and education professionals, provides materials for a plumbing procedures unit of seven lessons. Lesson topics are: safety procedures, joining pipes, water systems, fixtures and appliances, maintenance and repair, drainage systems, and cleaning plumbing fixtures. Each lesson includes some or all of the following color-coded components: performance objectives, information sheets, transparency masters, handouts, assignment sheets, job sheets, lesson tests, and answer key. (YLB)

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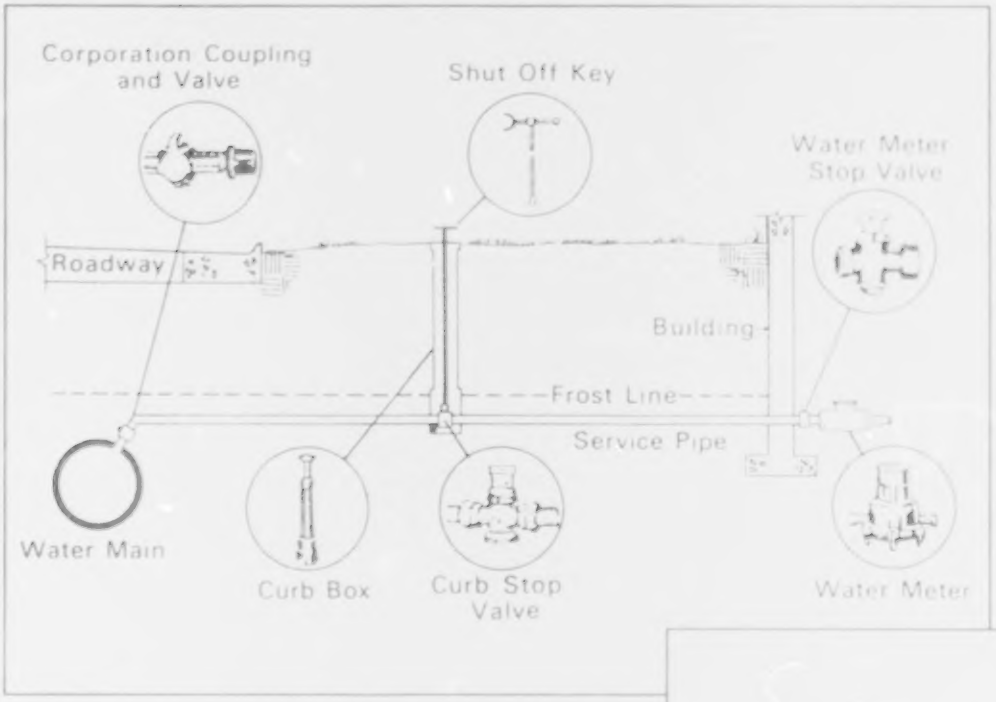

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Module III

Plumbing

CE 056 191

BUILDING MAINTENANCE

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Orientation to Building Maintenance

Carpentry and Finishing Procedures

Plumbing Procedures

Electrical Procedures and Environmental Control Systems

Masonry Procedures

Grounds Maintenance Equipment and Procedures

The activity which is the subject of this report was supported in whole or in part by funds from the Department of Elementary and Secondary Education, Division of Vocational and Adult Education. However, the opinions expressed herein do not necessarily reflect the position or policies of the Missouri Department of Elementary and Secondary Education or the Division of Vocational and Adult Education, and no official endorsement should be inferred.

BUILDING MAINTENANCE

Module III: Plumbing Procedures

prepared by

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April 1990

Instructor's Guide
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FOREWORD

We are indebted to the teachers and administrators who have provided their time, efforts and professionalism to the development of this guide. This guide is an outstanding example of what can be accomplished when the right people with the right attitude get together. The curriculum writers and subject matter experts who worked on this guide are to be commended for a job well done.

The Vocational Instructional Management System (VIMS) has become Missouri's framework for competency-based instruction; therefore, the Building Maintenance Curriculum Guide is designed to be totally integrated with the VIMS system. A curriculum guide is more than a resource--it is an integral part of the management system. Its purpose is to guide and facilitate competency-based instruction to help classroom teachers manage instruction.

The format of this guide has been set up for competency-based teaching and testing. Unit tests evaluate specific competencies and can be used with the Vocational Administrative Management System (VAMS). All information sheets, transparency masters, job sheets, assignment sheets and test items are keyed to specific competencies. A cross reference table has been included to quickly identify parts of the curriculum that relate to specific competencies. The material has also been packaged for students.

Competencies are stated prior to instruction and the student knows what the basis for evaluation will be. Each student is thus held responsible for mastering the competencies. The basis for grading is attainment of competencies rather than measurement against other students.

Although this guide may be a new format and new system for many teachers, we are confident that, when used as designed, time spent by teachers and students will become more productive. Any future building maintenance curriculum modifications will begin with this guide. We will evaluate the need to update this guide on a module-by-module basis. Your suggestions regarding areas for improvement are both encouraged and appreciated.

Judith Moore, Supervisor
Industrial Education
Department of Elementary and Secondary Education

Chuck Waibel, Director
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ACKNOWLEDGEMENTS

This building maintenance guide represents a continuing commitment to Missouri's Vocational Instructional Management System (VIMS). The guide has been keyed to the building maintenance competency profile developed by industry and education professionals in the state.

When searching for current building maintenance materials to adopt or utilize in the guide's development, comparable materials were found from the Occupational Curriculum Laboratory of East Texas State University and the Curriculum and Instructional Materials Center of Stillwater, Oklahoma. These materials have been utilized as a resource for this guide. A debt of thanks is owed to the Occupational Curriculum Laboratory and the Curriculum and Instructional Materials Center for the research and development of these building maintenance materials.

These educators contributed to the guide as members of the advisory and fieldtest committees:

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COMPETENCIES ADDRESSED IN THIS MODULE

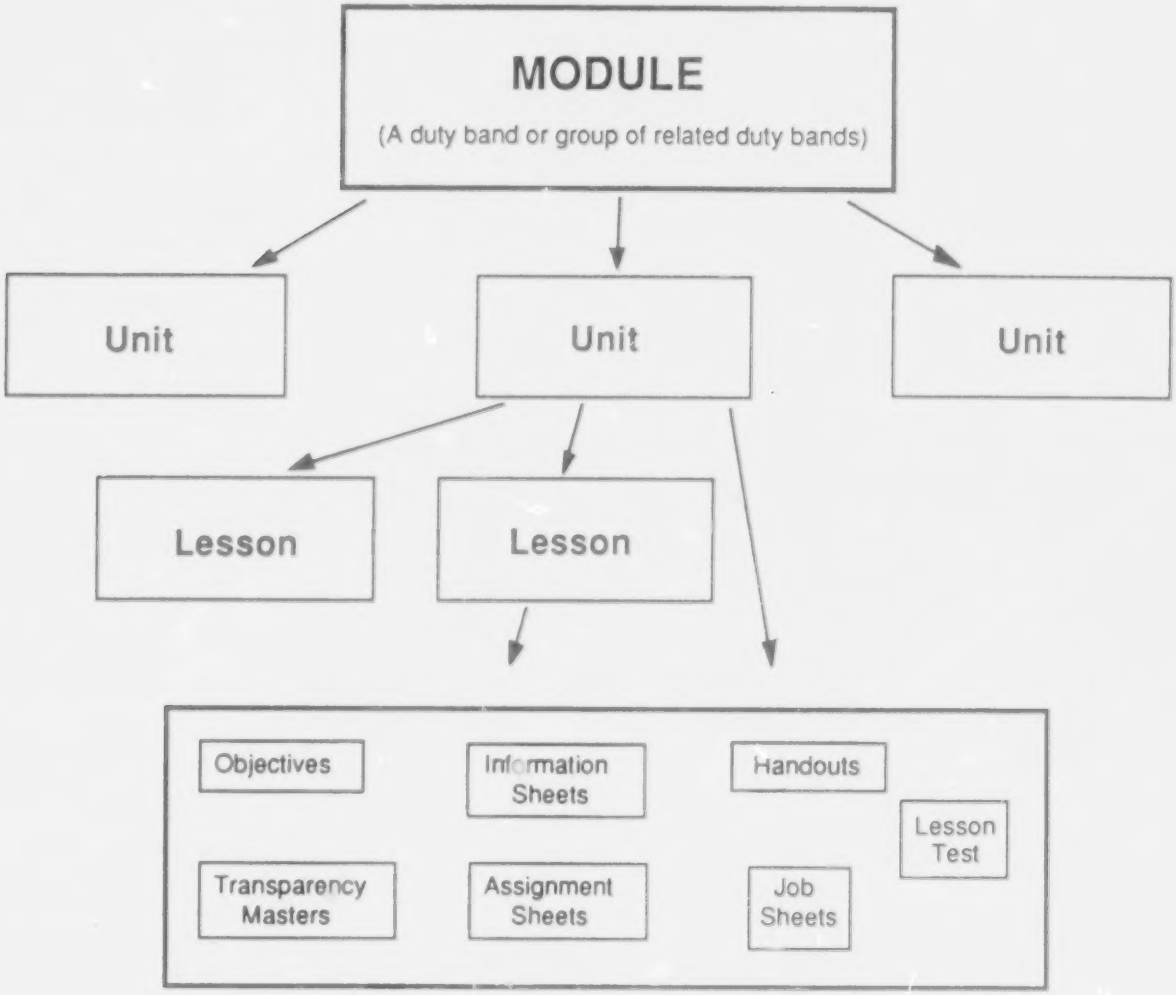
1. Identify plumbing safety practices
2. Cut and glue plastic pipe
3. Cut and solder copper pipe
4. Cut and thread pipe
5. Form a flare
6. Install compression fitting
7. Rough-in plumbing fixtures
8. Install plumbing fixtures
9. Repair/replace faucets/valves
10. Locate and repair leaks in pipes and lines
11. Clean traps, drains and vents
12. Clean and sanitize plumbing fixtures

HOW TO USE THIS PUBLICATION

GUIDE COMPONENTS

Units of Instruction

This Building Maintenance guide contains six modules of instruction. Within each module are instructional units including some or all of the following components: performance objectives, information sheets, transparency masters, handouts, assignment sheets, job sheets and lesson tests.



Competency profile

On the Missouri competency profile, tasks are divided into general subject areas, or duty bands, which are identified by a capital letter. Under each duty are related tasks (competencies), which are identified by an Arabic numeral. To evaluate the student's performance of the competencies, a 3-2-1-N grading system is used where:

3 = **Mastery**--can work independently with no supervision
2 = **Requires supervision**--can perform job completely with limited supervision
1 = **Not mastered**--requires further instruction and close supervision
N = **No exposure**--no experience or knowledge in this area

Cross-reference table (color-coded white)

Once the numbering system is understood, this table quickly reveals how the instructional components of the module relate to Missouri competencies. On the competency profile, tasks are divided into general subject areas, or duty bands, which are identified by a capital letter. Under each duty band are related tasks (competencies), which are identified by an Arabic numeral.

On the cross-reference table, unit numbers are represented by Roman numerals (I, II, III, etc). Other components of the module (transparencies, handouts, assignment sheets and job sheets) are shown with Arabic numerals. By looking at the cross-reference table, the instructor can quickly determine what test questions or job sheets a student needs to receive an evaluation for on a particular competency.

Objectives (color-coded white)

Each unit is based on performance objectives which state the measurable unit and specific behavioral or performance objectives that students are expected to achieve. Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the objectives and how they are intended to be used. Teachers should feel free to add/adapt objectives which will fit the material to student and community needs. Supporting material will, of course, need to be added for any new objectives.

Table of contents, references (color-coded white)

These pages have been coded pink for instructor use only. The reference section lists materials used as sources in developing the material.

Information sheets (green)

Presented in outline form for clarity, these pages provide content essential for meeting the cognitive (knowledge) objectives in the unit. Students should study the information sheets before class discussion or completion of assignment sheets.

Transparency masters (white)

Transparencies provide information by visually reinforcing or clarifying ideas presented in the information sheets. They are effective when identification is necessary and when they direct the student's attention to the topic of discussion. Transparencies should be left on the screen only when topics shown are under discussion.

Handouts (white)

Whenever more detailed information than can be presented in a transparency is needed, a handout is used. Handouts give the students additional information that can be kept with their class notes or student references.

Assignment sheets (tan)

Assignment sheets furnish paper-and-pencil practice to develop the knowledge necessary as a prerequisite to skill development. They can be given to students for class completion or used as homework assignments. Answer sheets (color-coded pink) can be used by the student or instructor to check progress.

Job sheets (blue)

These evaluation instruments are provided for two purposes: to outline steps of procedure and to check student performance mastery. Job sheets begin with a list of tools and materials needed for the activity. Job sheets furnish potential employers with a picture of skills being taught and performance which might be reasonably expected from a vocational student. The spaces to the right of the page on a job sheet assist the instructor in evaluating a student on a particular activity. This 3-2-1-N grading system is the same as the one used on the competency profile.

Lesson test (yellow)

Competency-based tests are designed to help eliminate subjective testing and to improve student evaluation and accountability. Specific competencies and test questions are linked on the answer key. These lesson tests have been written to be used with

computerized VAMS (Vocational Administrative Management System), utilizing Scantron sheets for computer-recording of test answers.

The lesson test may be eliminated if the competency was thoroughly evaluated by job sheets. However, an emphasis should be placed on cognitive as well as performance skills. If the objective or competency will be evaluated by a job sheet, it is often necessary to determine by a written test whether the student understands enough of the material to perform the job sheet.

SUGGESTED ACTIVITIES

The following list of suggested activities may be helpful.

1. Provide students with objective sheet and information sheets.
2. Discus specific objectives.
3. Discuss information sheets, assignment sheets and/or job sheets, lesson-by-lesson.
4. Have students do assignment sheet(s) to satisfactory levels.
5. Give students lesson test.
6. After successful completion of the test, have students do job sheet(s).

Students should perform the following activities.

1. Read objective sheet.
2. Study information sheets.
3. Do assignment sheet(s).
4. Take lesson test.
5. Do job sheets.

PACKAGING

This Building Maintenance guide has been packaged with an entire class in mind. For the teacher, a complete instructor's guide contains all six modules. In the student reference, selected portions have been reproduced for student use (objectives, information sheets, handouts). Student work sheets (assignment sheets, job sheets, lesson tests) have been packaged together for student distribution as the instructor deems necessary.

In the student reference, page numbers do not run consecutively because some pages have been removed that appear only in the instructor's guide.

Building Maintenance

Module: Plumbing Procedures

Cross-Reference Table of Instructional Materials

Competency	Unit	Instructional Objective	Transparency Master	Handout	Assignment Sheet	Job Sheet	Test Item	Notes
C-1	I	1.1-1.11	1-3		1		1-62	
C-2	II	2.1-2.9	1-5			1-5	1-50	
C-3	II	2.1-2.9	1-5			1-5	1-50	
C-4	II	2.1-2.9	1-5			1-5	1-50	
C-5	II	2.1-2.9	1-5			1-5	1-50	
C-6	II	2.1-2.9	1-5			1-5	1-50	
C-7	III	3.1-3.13	1		2	1-3	1-52	
C-8	IV	4.1-4.12	1-7			1-8	1-72	
C-9	V	5.1-5.6	1-4			1-3	1-10	
C-10	V	5.1-5.6	1-4			1-3	1-10	
C-11	VI	6.1-6.7	1-3			1-4	1-15	
C-12	VII	7.1				1		

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 1: SAFETY PRACTICES

LESSON OBJECTIVE

After completion of this lesson, the student will be able to LIST RULES FOR PERSONAL SAFETY AND SELECT RULES FOR GENERAL AND SHOP AND FIELD SAFETY. The student will also be able to SELECT THE CORRECT FIRE EXTINGUISHER FOR THE CLASSES OF FIRE AND MATCH THE SAFETY COLOR CODE WITH STATEMENTS OF ITS USE. Mastery will be evidenced by correctly performing the procedures outlined on the assignment sheet and by scoring _____ percent on lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms associated with general safety to the correct definitions.
2. Match the seven colors of the safety color code to the correct applications of their use.
3. List rules for personal safety.
4. Select rules for general shop and field safety.
5. List steps in maintaining a clean and orderly shop.
6. Match the classes of fire to the correct statements defining each class.
7. Label the three components of the fire triangle.
8. Match the type or types of fire extinguishers to the class of fire they are used on.
9. Select steps to be followed in case of an accident in the plumbing shop.
10. Select the proper steps for lifting heavy objects.
11. Describe the steps to be followed in case of an accident.

Completion of the requirements of this lesson fulfills competency C-1 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 1: SAFETY PRACTICES

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Components of the fire triangle
   2. Types of fire extinguishers
   3. Lifting heavy objects

D. Assignment sheet
   1. Steps to follow in case of an accident

E. Answers to assignment sheet

F. Lesson test

G. Answers to lesson test

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 1: SAFETY PRACTICES

INFORMATION OUTLINE

I. Terms and definitions

A. Safety--state or condition of being safe; freedom from danger, risk or injury

B. Accident--includes any suddenly occurring, unintentional event which causes injury or property damage

C. First aid--immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

D. O.S.H.A.--Occupational Safety and Health Act; federal legislation designed to insure safe and sanitary working conditions for employees

(Note: Refer to your own state organization)

II. Colors and applications of the safety color code

(Note: Refer to the National Safety Code)

A. Federal safety red
   1. Location of the fire fighting equipment
   2. Portable containers of flammable liquids
   3. Emergency stop bars, stop buttons, and emergency electrical switches on machinery

B. Federal safety yellow
   1. Caution--and for marking physical hazards
   2. Waste containers for explosive or combustible materials
   3. Caution against starting, using, or moving equipment under repair
   4. Identification of the starting point or power source of machinery

C. Federal safety orange
   1. Dangerous parts of machines
   2. Safety starter buttons and parts of equipment that may cause electrical shock
   3. Exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power jaws

D. Federal safety purple--radiation hazards

E. Federal safety green
   1. Safety
   2. Location of first aid equipment

   (Note: This applies to equipment other than fire fighting equipment)

F. Federal safety black
   1. Traffic flow
   2. Housekeeping purposes

G. Federal safety white
   1. Traffic flow
   2. Housekeeping purposes

   (Note: Black and white are used individually or in combination)

III. Rules for personal safety

A. Wear shop clothing appropriate to the instructional activity being performed

B. Confine long hair before operating rotating equipment

C. Always wear safety glasses; use suitable helmets and goggles for welding

D. Remove ties when working around machine tools or rotating equipment

E. Remove all metal jewelry when working

F. Conduct oneself in a manner conducive to safe practices

G. Use soap and water frequently as a method of preventing skin irritation

IV. Rules for general shop and field safety

A. Tools and equipment

1. Keep all hand tools sharp, clean, and in safe working order
2. Report any defective tools, machines, or other equipment to the instructor
3. Retain all guards and safety devices except with the specific authorization of the instructor
4. Operate a hazardous machine only after receiving instruction on how to operate the machine safely
5. Turn off the power before leaving a power tool
6. Make sure all guards and barriers are in place and adjusted properly before starting a machine tool
7. Disconnect the power from machine tools before performing the maintenance task of oiling or cleaning
8. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it
9. Use correct, properly fitting wrenches for nuts, bolts, and objects to be turned or held
10. Use proper tools and equipment for the proper job
11. All revolving machine parts should be well guarded
12. Do not run over extension or drop cords with appliance dolly
13. Do not leave tools on the floor
14. Make sure everyone is clear if using compressed air to clean

B. Accidents and Safety

1. Report all accidents to the instructor regardless of nature or severity
2. Wear safety clothing such as goggles, gloves, shoes, and aprons when welding
3. Consider the safety of others when working in the shop
4. Report any condition that may lead to an accident
5. Watch the bulletin board for safety information and notices
6. Conduct oneself in a safe-like manner at all times
7. Do not throw any object
8. Control temper and don't take chances
9. Wear gloves when handling material with sharp edges
10. Operate equipment and machines only when permitted by instructor
11. Do not distract the attention of a machine operator while working

12. Do only approved work in shop
13. Check all equipment before turning on switch
14. Do not work in the dark; use plenty of light
15. All accidents should be recorded in writing
16. All injuries must be given prompt attention
17. Do not work overtime in the shop without the instructor being present

C. Housekeeping
1. Keep the shop or job site floor clear of scraps and litter
2. Clean up any spilled liquids immediately
3. Store oily shop towels or oily waste in metal containers
4. Clean the chips from a machine with a brush; do not use a towel, bare hands or compressed air

V. Steps in maintaining a clean and orderly shop

A. Machinery and equipment arranged to permit safe, efficient work practices and ease in cleaning

B. Materials and supplies safely stacked or stored in proper places

C. Tools and accessories safely stored in cabinets, on racks, or other suitable devices

D. Working areas and work benches clear and free of debris and other hazards

E. Floors clean and free from obstructions and slippery substances

F. Aisles, traffic areas, and exits free of materials and other debris

G. Combustible materials properly disposed of or stored in approved, labeled containers

H. Oily towels stored in approved metal containers

I. Students working in the area instructed on the proper procedures to follow in keeping the area clean and orderly

J. Sufficient brooms, brushes, and other housekeeping equipment readily available

K. Drinking fountain and wash facilities should be kept clean and neat at all times

VI. Classes of fires

A. Class A--Fires that occur in ordinary combustible materials

Examples: Wood, rags, and rubbish

B. Class B--Fires that occur with flammable liquids

Examples: Gasoline, oil, grease, paints, and thinners

C. Class C--Fires that occur in or near electrical equipment

Examples: Motors, switchboards, and electrical wiring

D. Class D--Fires that occur with combustible metals

Example: Magnesium

VII. Components of the fire triangle (TM 1)

A. Fuel--Any combustible material

B. Heat--Enough to raise the fuel to its ignition temperature

C. Oxygen--Necessary to sustain combustion

(Note: To produce fire these three elements are necessary and must be present at the same time --if any one of the three is missing, a fire cannot be started--with the removal of any one of them, the fire will be extinguished)

VIII. Types of fire extinguishers and classes of fires (TM 2)

A. Pressurized water--Operates usually by squeezing a handle or trigger; used on Class A fires

B. Soda acid--Operates by turning extinguisher upside down; used on Class A fires

C. Carbon dioxide (CO_2)--Operates usually by squeezing handle or trigger; used on Class B and C fires

D. Dry chemical--Operates usually by squeezing a handle, trigger, or lever; used on Class B, C, and D fires

(Note: On Class D fires, dry sand is as effective as any dry chemical other than Purple X. The cost of the Purple X chemical places it out of reach of most shops)

E. Foam--Operates by turning extinguisher upside down; used on Class A and B fires

IX. Steps to be followed in case of an accident in the shop

A. Report all accidents and injuries to the instructor no matter how minor they may seem

B. First aid will be administered if needed

(Note: Check with local school policy)

C. Student will be taken to school nurse

D. Student's parent or guardian will be notified if school nurse requires student to see a physician

E. Investigation of the accident will take place to determine the cause of the accident and determine ways to prevent the same accident from happening again

F. Accident report form will be filled out by instructor

X. Steps for lifting heavy objects (TM 3)

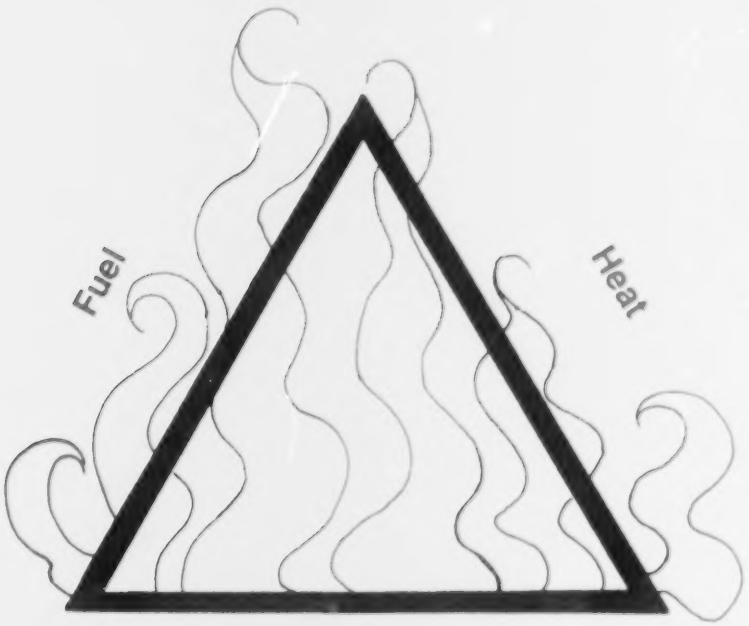
A. Bend knees

B. Keep back straight

C. Lift gradually with leg muscles

Components of the Fire Triangle

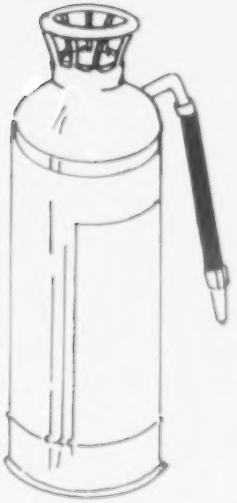
To produce fire, three things must be present at the same time.



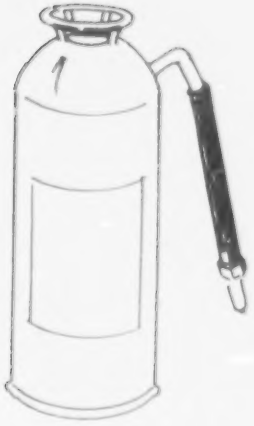
If any one of the three is missing, a fire cannot be started
or
with the removal of any one, the fire will be extinguished.

Types of Fire Extinguishers

Pressurized Water
(Class A)



Soda-Acid
(Class A)



Foam
(Class A and B)

Carbon Dioxide
(Class B and C)

Dry Chemical
(Class B, C, and D)

PP 13

TM 2

Steps for Lifting Heavy Objects

1. Bend knees
2. Keep back straight
3. Lift gradually with leg muscles

STEPS TO FOLLOW IN CASE OF ACCIDENT

Directions: Given the accident below, discuss the steps to be followed and state the safety rule that would have prevented the accident from occurring.

A student is removing a sheet metal panel and cuts the palm of his hand to the bone.

Completion of this assignment sheet partially fulfills competency C-1 of Building Maintenance.

ANSWERS TO ASSIGNMENT SHEET 1

Discussion should include:

1. Report all accidents and injuries to the instructor no matter how minor they may seem

2. First aid will be administered if needed

   (Note: Check with local school policy)

3. Student will be taken to school nurse

4. Student's parent or guardian will be notified if school nurse requires student to see a physician

5. Accident report form will be filled out by instructor

6. Investigation of the accident will take place to determine the cause of the accident and determine ways to prevent the same accident from happening again

The safety rule should be stated as follows:

A. Wear gloves when handling material with sharp edges

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 1: SAFETY PRACTICES

LESSON TEST

Part 1. Match the terms below to the correct definition.

A. Safety B. Accident C. First aid D. O.S.H.A.

_____1. Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

_____2. State or condition of being safe; freedom from danger risk or injury

_____3. Includes any suddenly occurring, unintentional event which causes injury or property damage

_____4. Occupational Safety and Health Act; federal legislation designed to insure safe and sanitary working conditions for employees

Part 2. Match the colors of the safety color code below to the correct applications of their use.

A. Federal safety green
B. Federal safety white
C. Federal safety orange
D. Federal safety purple
AB. Federal safety black
AC. Federal safety red
AD. Federal safety yellow

_____5. Caution and for marking physical hazards

_____6. Location of fire fighting equipment

_____7. Location of first aid equipment

_____8. Dangerous parts of machines

_____9. Housekeeping purposes

____10. Traffic flow

____11. Radiation hazards

Part 3. Match the classes of fire below to the correct statements defining each class.

A. Class A B. Class B C. Class C D. Class D

_____12. Fires that occur with flammable liquids

_____13. Fires that occur in ordinary combustible materials

_____14. Fires that occur in or near electrical equipment

_____15. Fires that occur with combustible metals

Part 4. Match the type or types of fire extinguishers below to the class of fire they are used on.

A. Pressurized water
B. Carbon dioxide (CO^2)
C. Dry chemical
D. Soda acid
E. Foam

_____16. Class B

_____17. Class C

_____18. Class A

_____19. Class D

Part 5. Select rules for general shop and field safety by placing an "X" in the appropriate blanks.

_____20. Keep all hand tools sharp, clean and in safe working order

_____21. Operate a hazardous machine if you think you can operate the machine

_____22. Report all accidents to the instructor regardless of nature or severity

_____23. Leave the power on a machine tool so the next person may operate it

_____24. Oil or clean machine tools with the power on

_____25. Use correct, properly fitting wrenches for nuts, bolt, and objects to be turned or held

_____26. Throw scraps and litter on the shop floor

_____27. Let spilled liquids stay on the floor until they dry out

_____28. Store oily shop towels or oily waste in metal containers

_____29. Use bare hands to clean chips from a machine

_____30. Wear safety clothing such as goggles, gloves, shoes, and aprons when welding

_____31. Report any condition that may lead to an accident

_____32. Show your temper and take chances while working in the shop

_____33. Wear gloves when handling material with sharp edges

_____34. Do not distract the attention of a machine operator while working

_____35. Make sure everyone is clear if using compressed air to clean

_____36. All revolving machine parts should be well guarded

Part 6. Select the steps to be followed in case of an accident in the plumbing shop by placing an "X" in the appropriate blanks.

_____37. Investigation of the accident will take place to determine the cause of the accident and determine ways to prevent the same accident from happening again

_____38. Apply a tourniquet

_____39. Student's parent or guardian will be notified if school nurse requires student to see a physician

_____40. First aid will be administered if needed

_____41. Mouth-to-mouth resuscitation will be administered in all cases

_____42. Student will be taken to school nurse

_____43. Student will be required to sign an insurance release form before he or she can be helped

_____44. Report all accidents and injuries to the instructor no matter how minor they may seem

_____45. First mop up blood to prevent a slick spot on the floor

_____46. Accident report form will be filled out by instructor

Part 7. Select the proper steps for lifting heavy objects by placing an "X" in the appropriate blanks.

_____47. Bend at the waist and lift straight up

_____48. Keep back straight

_____49. Straddle heavy objects before trying to lift

_____50. Bend knees

_____51. Lift in a quick jerking motion

_____52. Lift gradually with leg muscles

Part 8. List five rules for personal safety.

53.

54.

55.

56.

57.

Part 9. List five steps in maintaining a clean and orderly shop.

58.

59.

60.

61.

62.

Part 10. Label the three components of the fire triangle.

Part 11. Describe the steps to be followed in case of an accident.

(Note: If this activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

MODULE: PLUMBING PROCEDURES

ANSWERS TO UNIT I, LESSON 1 TEST

Part 1.

1. C
2. A
3. B
4. D

Part 2.

5. AD
6. AC
7. A
8. C
9. B and/or AB
10. B and/or AB
11. D

Part 3.

12. B
13. A
14. C
15. D

Part 4.

16. B, C, E
17. B, C
18. A, D, E
19. C

Part 5.

20. X	25. X	29.	33. X
21.	26.	30. X	34. X
22. X	27.	31. X	35. X
23.	28. X	32.	36. X
24.			

Part 6.

37. X	40. X	43.	46. X
38.	41.	44. X	
39. X	42. X	45.	

Part 7.

47.	50. X
48. X	51.
49.	52. X

Part 8. (53-57) Any five of the following:

a. Wear shop clothing appropriate to the instructional activity being performed

b. Confine long hair before operating rotating equipment

c. Always wear safety glasses; use suitable helmets and goggles for welding

d. Remove ties when working around machine tools or rotating equipment

e. Remove all metal jewelry when working

f. Conduct oneself in a manner conducive to safe practices

g. Use soap and water frequently as a method of preventing skin irritation

Part 9. (58-62) Any five of the following:

a. Machinery and equipment arranged to permit safe, efficient work practices and ease in cleaning

b. Materials and supplies safely stacked or stored in proper place

c. Tools and accessories safely stored in cabinets, on racks, or other suitable devices

d. Working areas and work benches clear and free of debris and other hazards

e. Floors clean and free from obstructions and slippery substances

f. Aisles, traffic areas, and exits free of materials and other debris

g. Combustible materials properly disposed of or stored in approved, labeled containers

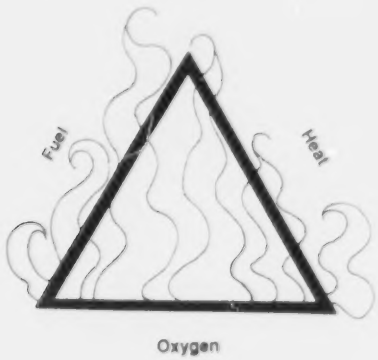
h. Oily towels stored in approved metal containers

i. Students working in the area instructed on the proper procedures to follow in keeping the area clean and orderly

j. Sufficient brooms, brushes, and other housekeeping equipment readily available

k. Drinking fountain and wash facilities be kept clean and neat at all times

Part 10.



Part 11. Evaluated to the satisfaction of the instructor

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 2: JOINING PIPES

LESSON OBJECTIVE

After completion of this unit, the student will be able to SELECT TOOLS, MATERIALS, AND EQUIPMENT NECESSARY TO JOIN PIPE. The student will also DEMONSTRATE THE ABILITY TO CUT AND THREAD PIPE, AND JOIN STEEL, COPPER, AND PLASTIC PIPE. Mastery will be evidenced by correctly performing the procedures outlined on the job sheets and by scoring_____percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms associated with joining pipe to the correct definitions or descriptions.
2. Select tools, materials, and equipment necessary to join steel pipe.
3. Select tools, materials, and equipment necessary to join copper tubing by the sweat joint, compression, and flare methods.
4. Select tools, materials, and equipment necessary to join P.V.C. pipe.
5. Cut, ream, thread and join a piece of 1" galvanized steel pipe to a 1" galvanized steel fitting.
6. Cut, ream, and join copper tubing using the sweat method.
7. Cut, ream, and join copper tubing using a compression joint.
8. Cut, ream, and join copper tubing using a flare joint.
9. Cut, ream, and join P.V.C. pipe to a P.V.C. fitting.

Completion of the requirements of this lesson fulfills competencies C-2, C-3, C-4, C-5, and C-6 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 2: JOINING PIPES

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Tools for cutting and threading iron pipe
   2. Tools to join copper tubing by the sweat joint method
   3. Tools to join copper tubing by compression method
   4. Tools to join copper tubing by the flare method
   5. Tools for making P.V.C. joints

D. Job sheets
   1. Cut, ream, thread, and join 1" steel pipe to 1" fitting
   2. Cut, ream, and join copper tubing using the sweat method
   3. Cut, ream, and join copper tubing using a compression joint
   4. Cut, ream, and join copper tubing using a flare joint
   5. Cut, ream, and join P.V.C. pipe to a P.V.C. pipe

E. Lesson test

F. Answers to lesson test

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 2: JOINING PIPES

INFORMATION OUTLINE

I. Terms and definitions of descriptions

A. Sweating--method of joining copper tubing using flux and solder applied with heat

B. Threading--cutting spiral grooves on the end of pipe to facilitate joining with a fitting or another pipe

C. Cementing--method of using a solvent to join P.V.C. pipe

D. Reaming--removing burrs from inside edge of pipe

E. Neoprene gasket--insert in cast iron hub which makes up part of a water tight compression joint

(Note: The "hub" is sometimes referred to as the "bell")

F. Pipe compound (dope)--substance applied to pipe threads to help seal the joint

G. Teflon tape--tape used as a joint sealant in place of pipe compound

II. Tools, materials and equipment necessary to join wrought pipe (TM 1)

A. Cutter

B. Reamer

C. Pipe vise

D. Oil can

E. Adjustable stock-and-die set

F. Pipe compound or tape

G. Pipe wrench

H. Pipe

I. Fitting

III. Tools, materials, and equipment necessary to join copper tubing (TM 2, TM 3, TM 4)

A. Sweat joint method
1. Tubing cutter
2. Reamer
3. Sand cloth, emery cloth, steel wool
4. Flux with brush
5. Wire solder
6. Torch
7. Type B gas tank with wrench
8. Striker
9. Wiping cloth
10. Tubing
11. Fitting
12. Fire extinguisher

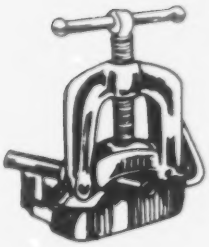
B. Compression method
1. Tubing cutter
2. Reamer
3. Fitting
4. Open-end wrench or flare-nut wrench
5. Adjustable open end wrench
6. Tubing

C. Flare method
1. Tubing cutter
2. Reamer
3. Flaring tool and block
4. Open-end wrench or flare-nut wrench
5. Adjustable wrench
6. Tubing
7. Fitting
8. Hammer type flaring tool
9. Swaging tool

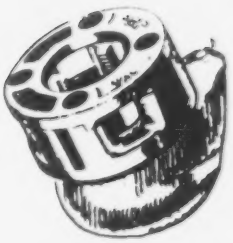
IV. Tools, materials, and equipment necessary to join P.V.C. and flexible plastic pipe (TM 5)

A. P.V.C. pipe
1. P.V.C. pipe cutter or hacksaw
2. Reamer or knife
3. Cleaning solvent with brush
4. Solvent cement with brush
5. Pipe
6. Fitting
7. Wiping cloth

Tools for Cutting and Threading Iron Pipe



Pipe Vise

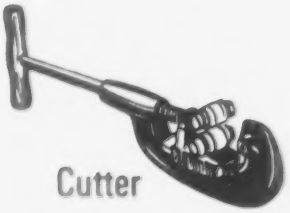


Die Head

Reamer

Oil Can

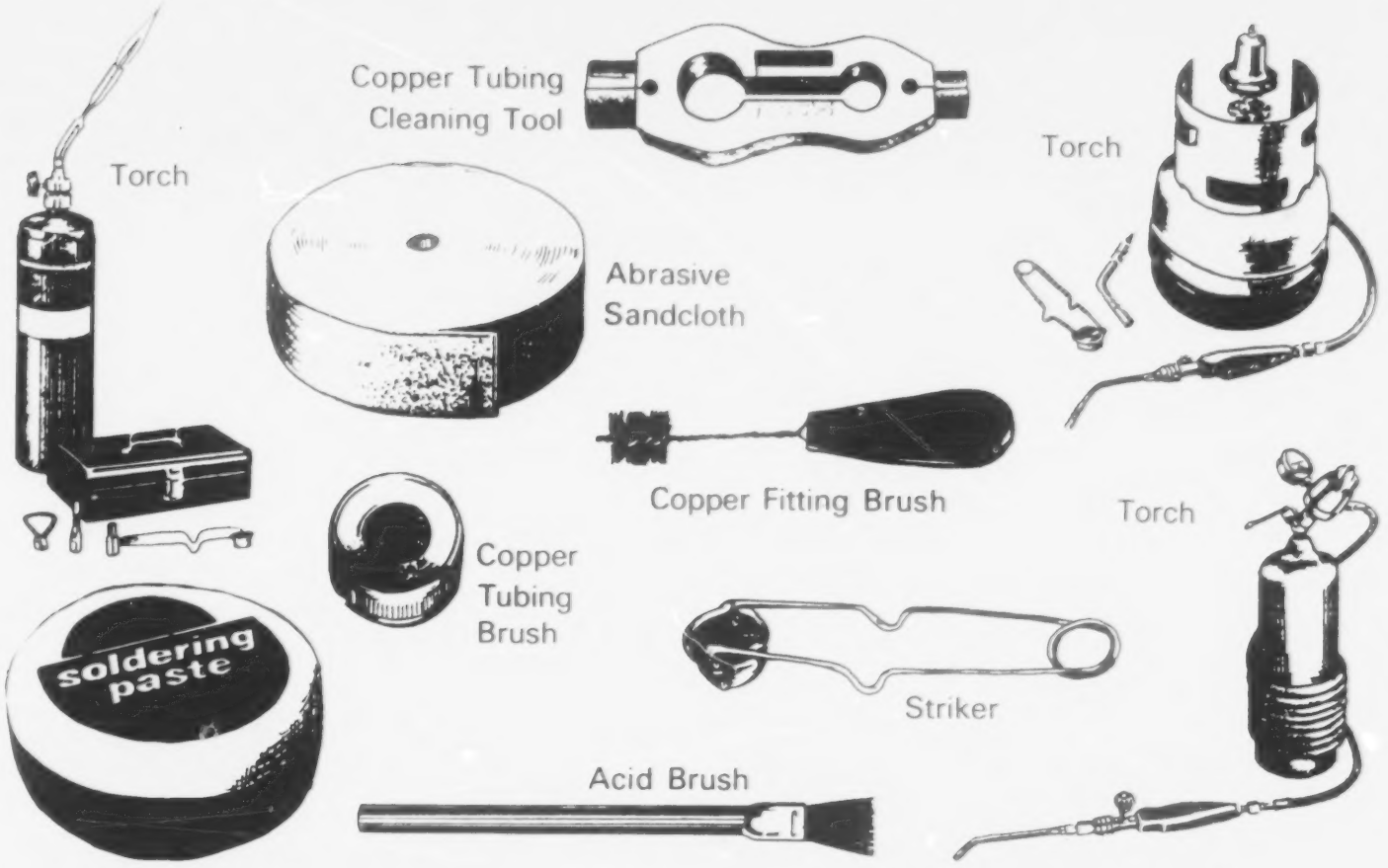
Die Stock



Cutter

4–Wheel Pipe Cutter

Tools to Join Copper Tubing by the Sweat Joint Method



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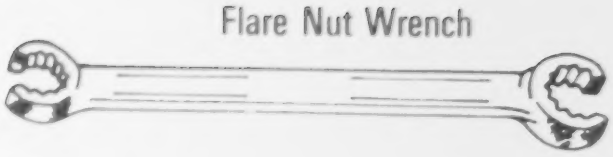
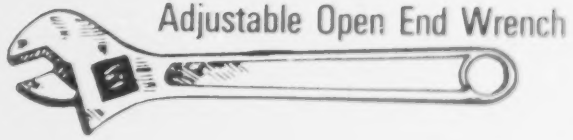
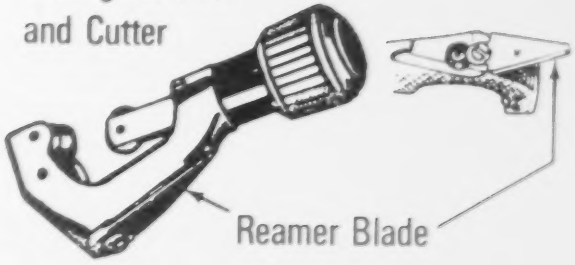
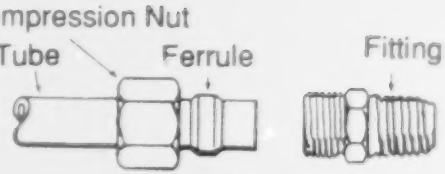
TM 2

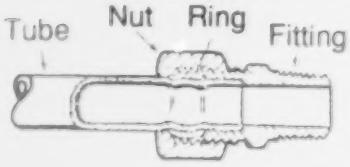
Tools to Join Copper Tubing by the Compression Method

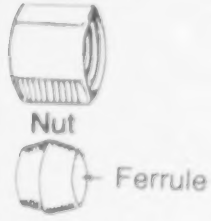












Fittings

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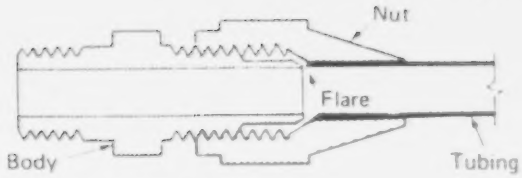
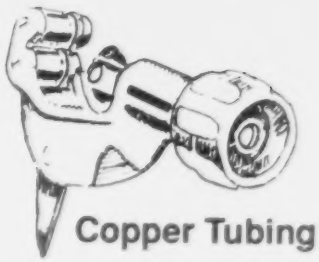
TM 3

Tools to Join Copper Tubing by the Flare Method

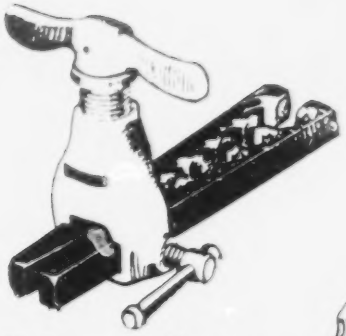


Flare Connection



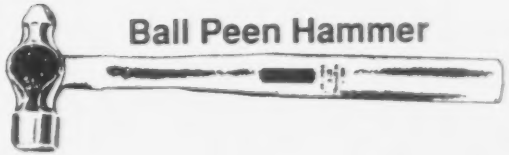
Copper Tubing Cutter

Swaging Tool



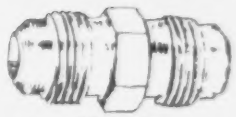
Yoke and Screw Flaring Tool

Hammer Type Flaring Tool

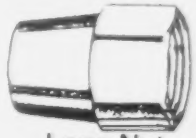


Ball Peen Hammer

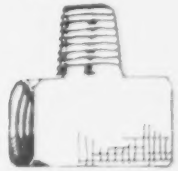
Flared Fittings



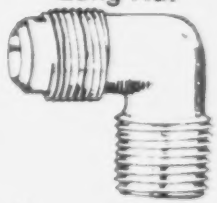
Union



Long Nut



T (Flare-to-Flare to male pipe thread)



Male L

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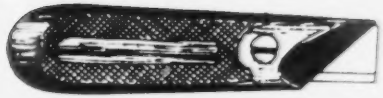
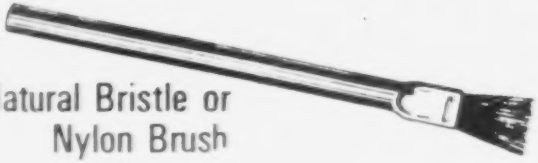
Tools for Making P.V.C. Joints

P.V.C. Cement



Knife

P.V.C. Cleaner



Natural Bristle or
Nylon Brush

Clean Towels

Handsaw

PP 45

TM 5

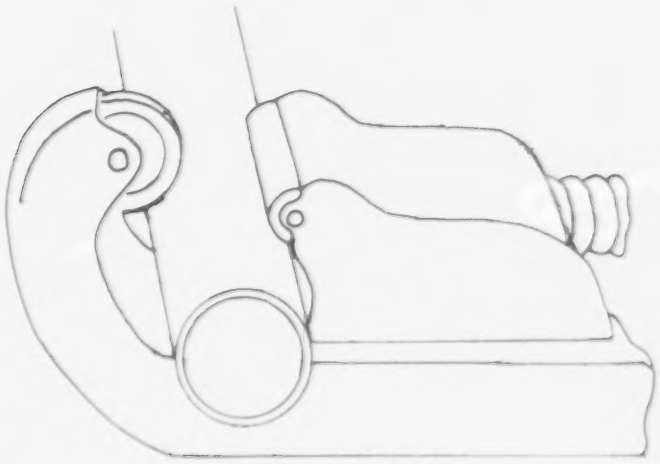
CUT, REAM, THREAD, AND JOIN A PIECE OF ONE INCH GALVANIZED STEEL PIPE TO A ONE INCH FITTING

Equipment:

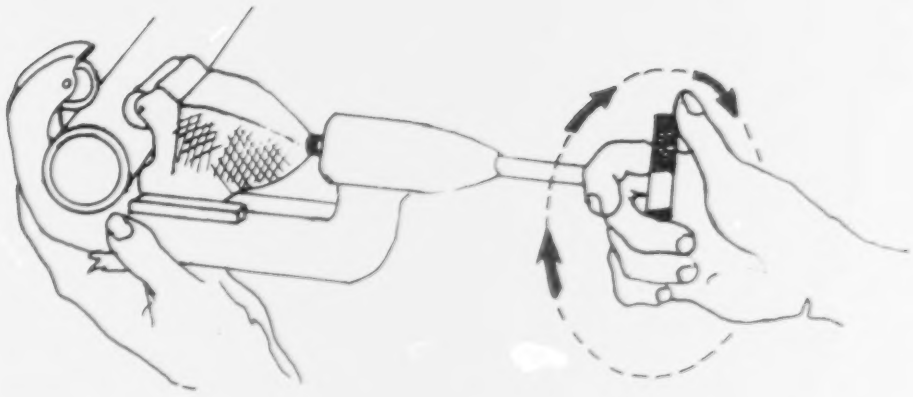
Die
Die stock
Pipe vise
Flat file
Oil can (cutting oil)
Steel pipe
Pencil
Shop towel
Safety glasses
Pipe cutter
Reamer

(Note: Ask the instructor what type and size of steel pipe to use for this job.)

Procedure:	Evaluation 3	2	1	N
1. Put on safety glasses and gather tools and equipment.	__	__	__	__
2. Secure pipe in vise.	__	__	__	__
3. Mark place for cut with pencil.	__	__	__	__
4. Open pipe cutter until it will fit over pipe.	__	__	__	__
5. Locate cutter wheel on the pencil mark.	__	__	__	__

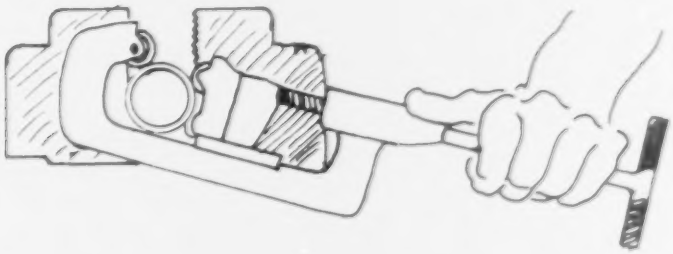


6. Snug cutter up to pipe by rotating screw handle. _ _ _ _



7. Rotate cutter counterclockwise to start groove. _ _ _ _ _
Tighten cutter hand 1/4 of a turn for each full revolution around the pipe. _ _ _ _ _

(Note: Overtightening can cause cutters to break.)



8. Tighten cutter hand 1/4 of a turn for each full revolution around the pipe. _ _ _ _ _

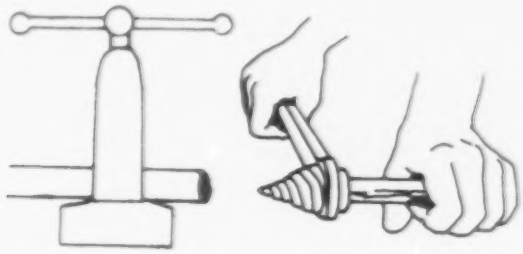
(Note: Overtightening can cause cutters to break.)

9. Continue process until pipe is cut. _ _ _ _

(CAUTION: When cutting short pieces of pipe be careful not to cut your arm while rotating the cutter around the pipe.)

10. Clean pipe and cutter with shop towel. _ _ _ _

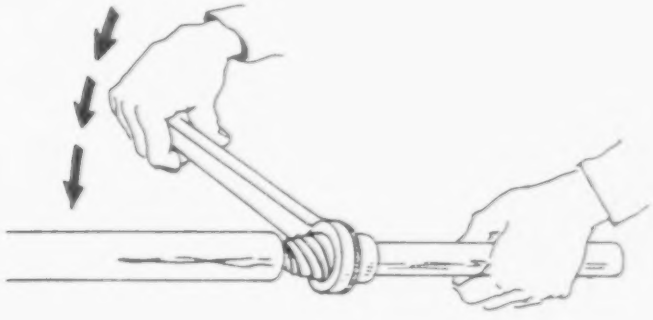
11. Insert reamer tip in pipe. _ _ _ _



12. Apply light forward pressure to push reamer into pipe. _ _ _ _

13. Start rotating reamer. _ _ _ _

(Note: Reamer should bite instantly if proper pressure is applied. Reamer can be damaged if rotated in the wrong direction.)

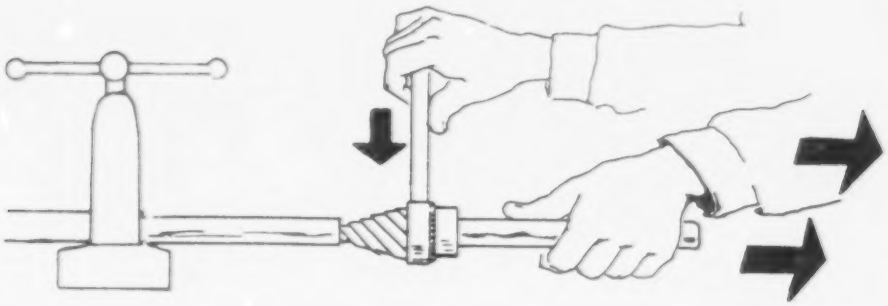


14. Rotate reamer until burrs are removed. _ _ _ _

(Note: This is a developed skill; the reamer can be pulled out and your progress inspected.)

15. Pull reamer back while continuing to rotate. _ _ _ _

(Note: This prevents the reamer from leaving a burr.)



16. Clean reamer with shop towel. _ _ _ _

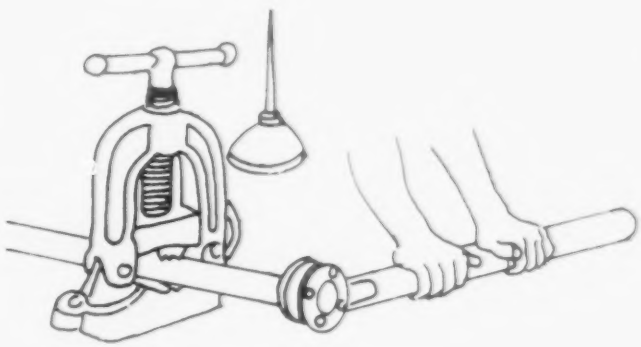
17. Lubricate end of pipe with cutting oil. _ _ _ _

18. Place die in die stock and secure. _ _ _ _

19. Place die on pipe. _ _ _ _

20. Start die straight on the pipe. _ _ _ _

21. Press die on pipe evenly and turn the die. _ _ _ _



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22. Apply plenty of cutting oil while turning the die. _ _ _ _

(Note: Place a container under pipe vise to catch dripping oil.)

23. Continue this procedure until the desired amount of threads have been cut. _ _ _ _

24. Release die by turning ratchet lock 180°. _ _ _ _

25. Remove die by turning counterclockwise. _ _ _ _

(Note: Hold onto the die stock firmly while removing it so as not to drop it when it comes to the end of the threads.)

26. Clean threads with a brush. _ _ _ _

(CAUTION: Do not use compressed air for cleaning.)

27. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _ _ _ _

Average of above evaluations* _ _ _ _

*This average is the student's partial evaluation for competency C-4.

CUT, REAM, AND JOIN COPPER TUBING USING THE SWEAT METHOD

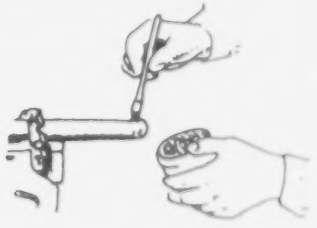
Equipment:

Tubing cutter
Reamer
Sand cloth, emery cloth, steel wool
Flux
Torch
Gas tank w/wrench
Striker
Wire solder
Wiping cloth
Tubing
Fitting
Colored safety glasses

Procedure:

		Evaluation 3	2	1	N
1.	Put on colored safety glasses.	—	—	—	—
2.	Cut tubing to desired length.	—	—	—	—
3.	Ream end of cut tubing.	—	—	—	—
4.	Clean tubing end with sand cloth.	—	—	—	—
5.	Clean fitting socket with sand cloth.	—	—	—	—
6.	Apply thin coat of flux to tubing end and fitting socket.	—	—	—	—

(Note: A small brush used to apply the flux helps to keep out dirt.)



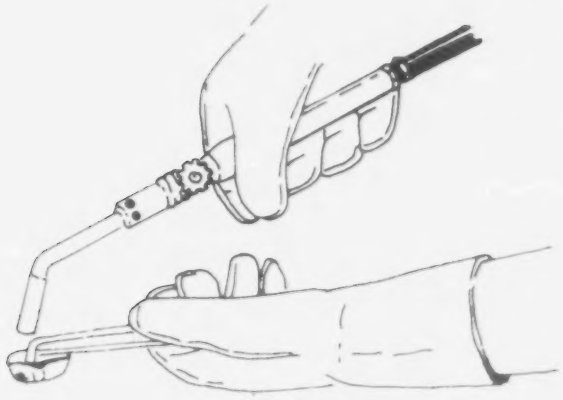
7.	Insert tubing end into fitting socket.	—	—	—	—

(Note: Twist the tubing while inserting in order to spread the flux evenly.)

8.	Clean away excess flux with cloth.	—	—	—	—
9.	Carefully secure tubing and fitting in vise.	—	—	—	—

10. Light and adjust torch. — — — —

(Note: Always use a striker.)



11. Apply heat to fitting. — — — —

(Note: The inner blue cone of the flame should be about 1/8" away from the fitting.)

12. Move the torch flame around the entire joint. — — — —

13. Apply solder. — — — —

(Note: Amount of solder is determined by size of tubing, i.e., 1/2" tubing will need approximately 1/2" wire solder, and 3/4" tubing 3/4" wire solder.)

14. Discontinue heat and solder application when solder flows from joint. __ __ __ __

15. If necessary, wipe excess solder off with cloth. __ __ __ __

16. Turn off torch. __ __ __ __

17. Allow solder to cool. __ __ __ __

(Note: Do not apply water to cool the fitting.)

18. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. __ __ __ __

Average of above evaluations* __ __ __ __

*This average is the student's partial evaluation for competency C-3.

CUT, REAM, AND JOIN COPPER TUBING USING A COMPRESSION JOINT

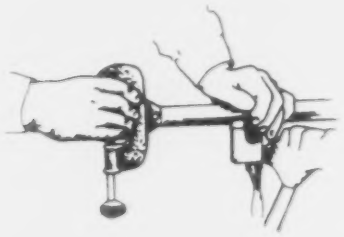
Equipment:

Tubing cutter
Reamer
Fitting
Tubing
Open-end wrench or flare-nut wrench
Adjustable wrench

Procedure:

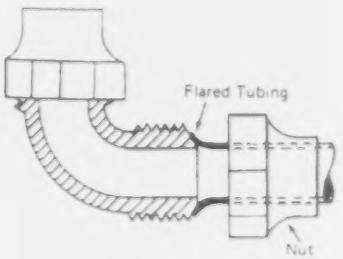
	Evaluation 3	2	1	N
1. Cut tubing to desired length.	—	—	—	—
2. Slip fitting nut and sleeve over end of tubing.	—	—	—	—
3. Ream end of tubing.	—	—	—	—

(Note: If tubing is reamed before installing fitting sleeve, the sleeve might not fit over end of tubing.)



4. Insert end of tubing into fitting.	—	—	—	—

(Note: Tubing end must fit snugly against bottom of fitting socket.)



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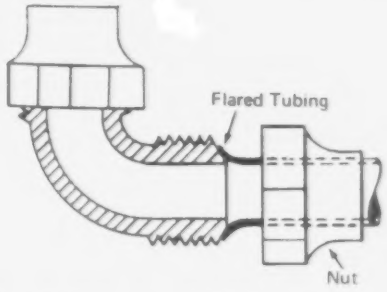
5. Slide fitting nut and sleeve up against threaded end of fitting. — — — —



6. Make nut hand-tight on fitting. — — — —

7. Hold body of fitting with adjustable wrench. — — — —

8. Turn fitting nut with flare-nut wrench or open-end wrench. — — — —

(Note: Keep tubing tight against bottom of fitting socket while tightening nut.)

9. Complete tightening of nut on fitting. — — — —

10. Duplicate process on other end of fitting. — — — —

11. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. — — — —

Average of above evaluations* — — — —

*This average is the student's partial evaluation for competency C-6.

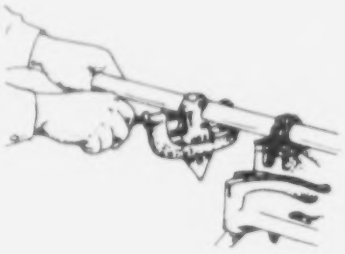
CUT, REAM, AND JOIN COPPER TUBING USING A FLARE JOINT

Equipment:

Tubing cutter
Reamer
Flaring tool and block
Tubing
Fitting
Adjustable wrench
Open-end or flare-nut wrench

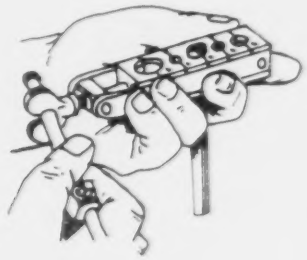
Procedure:

	Evaluation 3	2	1	N
1. Measure and cut a desired length of tubing.				
a. Place cutter on tubing; do not overtighten.	—	—	—	—



b. Turn a few revolutions and then tighten a little more.	—	—	—	—
c. Continue to tighten a little at a time while turning cutter.	—	—	—	—
(Note: Cutter should not be so tight that it bends the end of the tubing.)				
2. Slip flare nut over end of tubing.	—	—	—	—
3. Ream the end of the tubing.				
a. Do not over-ream; just remove the burr.	—	—	—	—
b. Point end of tubing slightly downward while reaming to allow chip to fall out.	—	—	—	—
4. Place tubing in flaring block.	—	—	—	—

5. Extend end of tubing above the block face about 1/3 the depth of the block chamfer. — — — —



6. Secure tubing in flaring block. — — — —

7. Place flaring tool on block. — — — —

(Note: Flaring tool must be kept oiled and clean.)

8. Tighten cone into tubing a few turns and then back it out. — — — —

9. Continue the tightening and loosening process until the flare is made. — — — —

(Note: This process tends to make a smooth, polished flare and will lessen the chances of work hardening the tubing.)

10. Do not overtighten the flaring tool. — — — —

(Note: This will cause the tubing to wash-out and possibly cause the flare to split.)

11. Remove flaring tool from block. — — — —

12. Remove tubing from flaring block. — — — —

13. Check fit of flare to seat of flare nut. — — — —

14. Secure flare nut tightly to flare fitting. — — — —

15. Duplicate process on other end of flare fitting. __ __ __ __

16. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. __ __ __ __

Average of above evaluations* __ __ __ __

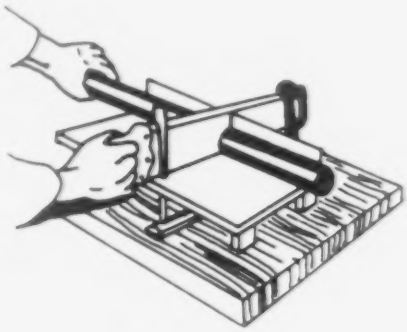
*This average is the student's partial evaluation for competency C-5.

CUT, REAM, AND JOIN P.V.C. PIPE TO A P.V.C. FITTING

Equipment:

Pipe cutter or handsaw with miter box
Reamer
Cleaning solvent with brush or abrasive paper
Solvent cement with brush
Pipe
Fitting
Wiping cloth

Procedure	Evaluation 3	2	1	N
1. Measure and cut pipe to desired length.	—	—	—	—
(Note: A miter box and miter saw insures a square cut.)				



2. Ream pipe.	—	—	—	—
(CAUTION: Since most P.V.C. reaming is done with a pocket knife or other types of knives, care must be exhibited in this operation.)				
3. Apply solvent cleaner to pipe end and fitting socket.	—	—	—	—
(Note: Abrasive paper such as sand cloth or emery cloth may be used.)				

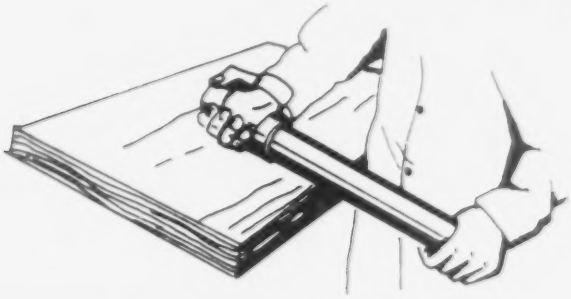
4. Wipe solvent cleaner from the pipe end and fitting socket. — — — —

(Note: This cleans the pipe and removes the gloss for better bonding.)

5. Apply a light, even coat of solvent cement to the pipe end and fitting socket. — — — —

6. Insert pipe all the way into the fitting socket while giving it a quarter turn. — — — —

(Note: This operation must be done quickly as the cement sets-up in a few seconds.)



7. Allow 30 seconds before testing P.V.C. joints. — — — —

8. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. — — — —

Average of above evaluations* — — — —

*This average is the student's partial evaluation for competency C-2.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 2: PIPE JOINING

LESSON TEST

Part 1. Match the terms below to the correct definitions.

A. Threading
B. Cementing
C. Reaming
D. Pipe compound (dope)
E. Sweating

_____ 1. Method of using a solvent to join P.V.C. pipe

_____ 2. Method of joining copper tubing using flux and solder applied with heat

_____ 3. Removing burrs from inside edge of pipe

_____ 4. Cutting spiral grooves on the end of pipe to facilitate joining with a fitting or another pipe

_____ 5. Substance applied to pipe threads to help seal the joint

Part 2. Select tools, materials, and equipment necessary to join steel pipe by placing an "X" in the appropriate blanks.

_____ 6. Cutter

_____ 7. Reamer

_____ 8. Open end wrench

_____ 9. Oil can

_____10. Aviation wire snips

_____11. Pipe vise

_____12. Adjustable stock-and-die set

_____ 13. Screwdriver

_____ 14. Pipe dope

_____ 15. Paint

_____ 16. Pipe wrench

_____ 17. Pipe

_____ 18. Fitting

Part 3. Select tools, materials, and equipment necessary to join copper tubing by the sweat joint, compression and flare methods by placing an "X" in the appropriate blank.

A. Sweat joint method

_____19. Tubing cutter

_____20. Fitting

_____21. Gas tank with wrench

_____22. Open-end wrench

_____23. Flux with brush

_____24. Sand cloth, emery cloth, steel wool

_____25. Solvent cement

_____26. Wire solder

_____27. Tubing

_____28. Handsaw

_____29. Torch

_____30. Striker

B. Compression method

_____31. Tubing cutter

_____32. Wire solder

_____33. Reamer

_____34. Flare-nut wrench

_____35. Tubing

_____36. Fitting

C. Flare method

_____37. Tubing cutter

_____38. Torch

_____39. Flaring tool and block

_____40. Cleaning solvent

_____41. Reamer

_____42. Flare-nut wrench

_____43. Adjustable wrench

Part 4. Select tools, materials, and equipment necessary to join P.V.C. pipe by placing an "X" in the appropriate blanks.

_____44. Handsaw with miter box

_____45. Reamer

_____46. Clamp

_____47. Screwdriver

_____48. Solvent cement with brush

_____49. Pipe

_____50. Cleaning solvent with brush

MODULE: PLUMBING PROCEDURES

ANSWERS TO UNIT I, LESSON 2 TEST

Part 1.

1. B	2. E	3. C	4. A	5. D

Part 2.

6. X	9. X	12. X	15.	18. X
7. X	10.	13.	16. X	
8.	11. X	14. X	17. X	

Part 3.A

19. X	22.	25.	28.	
20. X	23. X	26. X	29. X	
21. X	24. X	27. X	30. X	

Part 3.B

31. X	34. X			
32.	35. X			
33. X	36. X			

Part 3.C

37. X	40.	43. X		
38.	41. X			
39. X	42. X			

Part 4.

44. X	45. X	46.	47.	48. X
49. X	50. X			

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 3: WATER SYSTEMS

LESSON OBJECTIVE

After completion of this lesson, the student will be able to IDENTIFY THE COMPONENTS OF A RESIDENTIAL WATER SYSTEM, AND DESCRIBE METHODS OF TESTING WATER SYSTEMS. The student will also be able to DEMONSTRATE THE ABILITY TO MAKE AN ISOMETRIC DRAWING AND DETERMINE PIPE SIZES FOR A HOT AND COLD WATER SYSTEM. Mastery will be evidenced by correctly performing the procedures outlined on the assignment and job sheets and by scoring _____ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms associated with residential water systems to the correct definitions or descriptions.
2. Identify components of a water system in a single-family dwelling.
3. Match the components of a water system in a single-family dwelling to the correct functions.
4. Select factors to consider when installing a hot water system.
5. Select true statements about sizing of pipes in residential water systems.
6. Distinguish between materials used for pipes and materials used for valves in water pipe systems.
7. Select true statements about the prevention of frozen pipes in cold weather.
8. Make an isometric drawing of a hot and cold water system for a two-story house.
9. Determine pipe sizes for a hot and cold water system for a two-story house.

10. Rough-in water supply lines for bathtubs.
11. Rough-in water supply lines for water closets.
12. Rough-in water supply lines for water heaters.
13. Make water pressure tests on water supply systems.

Completion of the requirements of this lesson fulfills competency C-7 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 3: WATER SYSTEMS

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Components of a Residential Water System
   2. Components of a Residential Water System (Continued)
   3. Water Hammer Arresters
   4. Inlet and Outlet Pipe Sizing
   5. Sizing of Pipe
   6. Sizing of Pipe (Continued)
   7. Prevention of Frozen Pipes

D. Assignment sheets
   1. Make an isometric drawing of a hot and cold water system for a two-story house
   2. Determine pipe sizes for a hot and cold water system for a two-story house

E. Answers to assignment sheets

F. Job sheets
   1. Rough-in water supply lines for bathtubs
   2. Rough-in water supply lines for water closets
   3. Rough-in water supply lines for water heaters

G. Lesson test

H. Answers to lesson test

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 3: WATER SYSTEMS

INFORMATION OUTLINE

I. Terms and definitions

A. Cross connection--any link between contaminated water and potable water in the water system

B. Potable water--water which is satisfactory for drinking and domestic purposes

C. Frost line--the depth of frost penetration in the soil

(Note: Water pipes should be installed below the depth. In northern climates, the service pipe is buried as much as 7 feet or more deep in the ground)

D. Pressure head--amount of force or pressure created by the depth of one foot of water

E. Sill cock--a faucet on the outside of the building to which a garden hose can be attached

F. Shut-off valve--a full opening valve installed in the water line wherever a cut-off is required

G. Friction loss--flow pressure loss caused by liquid coming in contact with the inside of the pipe

II. Components of a water system in a single-family dwelling (TM 1, TM 2)

A. Water main (city main)

B. Corporation coupling and valve

C. Curb stop valve

D. Curb box

E. Service pipe

F. Water meter

G. Water meter stop valves

H. Main water line

I. Distribution pipes

J. Riser pipes

K. Air chambers

L. Water heater

M. Water conditioner (optional)

III. Components and functions (TM 3)

A. Water main--a large pipe, buried in the street, which distributes water throughout the town or city

B. Service pipe--water pipe which supplies water from the water main or other source of supply to the building served

C. Water meter--records amount of water consumed by residence or dwelling

D. Curb stop--a valve placed in the service line at or near the curb which permits easy control over the system

E. Curb box--a cylindrical casting placed over the curb stop to allow remote opening and closing of the stop

F. Distribution pipes--pipes which carry water from the service pipe to fixtures in the building

G. Meter stop--a valve installed between the street and the water meter

H. Riser pipes--pipes which rise vertically from a horizontal pipe

I. Shut-off valve--a valve installed in the water line wherever a cut-off is required

J. Air chamber--a closed section of pipe or coil, or a patented device designed to absorb shock caused by a rapidly closing valve or faucet; this prevents water-hammer and is installed at time of roughing in

K. Corporation stop--a valve installed in the service pipe at the water main

IV. Factors to consider when installing a hot water system (TM 4)

(Note: Refer to local codes)

A. Water heater is located according to
   1. Source of cold water supply
   2. Source of fuel supply
   3. Access to fuel exhaust if necessary

B. Main hot water pipe should be equal in size to the main cold water pipe

C. Inlet pipe to the water heater must be at least as large as the outlet pipe

D. Hot water distribution pipes are equal in sizing and design to the cold water distribution pipe

V. Sizing of pipes in residential water systems (TM 5, TM 6)

A. Most town or city water supplies are disbursed from elevated tanks which distribute the water by gravity

B. Water pressure increases as the height of the water increases

C. A 1-foot column of water will create .433 lbs. per square inch of pressure at the base of the column

   (Note: Width of the column has no effect on the pressure)

D. Distributions pipes vary in size according the their fixture application

E. Rule of thumb for distribution pipe sizes are:
   1. Up to three 3/8" branches can be supplied by a 1/2" pipe
   2. Up to three 1/2" branches can be supplied by a 3/4" pipe
   3. Up to three 3/4" branches can be supplied by a 1" pipe

F. Water flow pressure is reduced by friction loss caused by the water coming in contact with the inside of the pipe

   (Note: In long runs of pipe, consult charts for possible excessive friction loss)

G. Number and type of fittings affect water pressure

(Note: Economical use of fittings will reduce cost and help reduce pressure loss)

VI. Materials used in water pipe systems

A. Pipes
1. Copper
2. Plastic
3. Galvanized iron

B. Valves
1. Brass
2. Plastic
3. Galvanized iron

(Note: Brass far outlasts any other type valve and therefore is more popular)

VII. Prevention of frozen pipes in cold weather (TM 7)

A. Outside building pipe lines must be buried below frost line

(Note: Determine local conditions)

B. Insulate pipes in crawl spaces

(Note: Grade pipes for drainage)

C. Avoid installing pipes in outside walls

D. Install freeze-proof type hose bibs

E. If pipe is installed in an area subject to freezing, a drain valve must be installed

F. If in doubt, insulate or relocate pipes

(Note: An opposite situation can develop warm water in pipes if the pipes are too close to the surface and are affected by the heat of the sun)

VIII. Methods of preventing contamination of water systems by cross connections

A. Fixtures and fittings must be installed to provide an air-gap

(Note: Potable water systems must not inter-connect with other systems)

B. Vacuum breakers must be provided where necessary

IX. Testing water systems for leaks

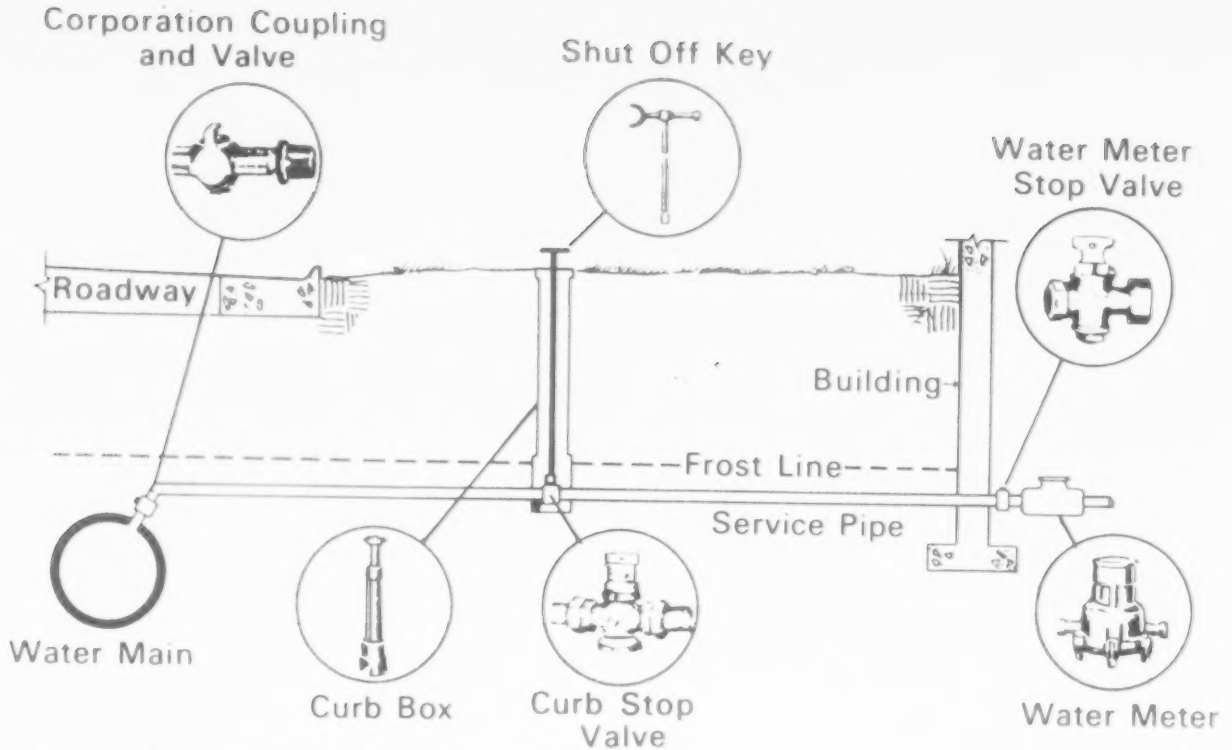
A. Water method
1. The test pressure should not be less than the pressure of the system to be used
2. Codes usually specify that water for these tests come from normal source of supply

(Note: Some codes specify that only water tests are acceptable)

3. Testing from the normal source of supply requires that the plumbing installation be connected to the street main or to a neighboring residence

B. Air method
1. Test pressure is usually 50 p.s.i. for 4 hours
2. Pressure gauge must be supplied and attached to piping installation by plumber

Components of a Residential Water System



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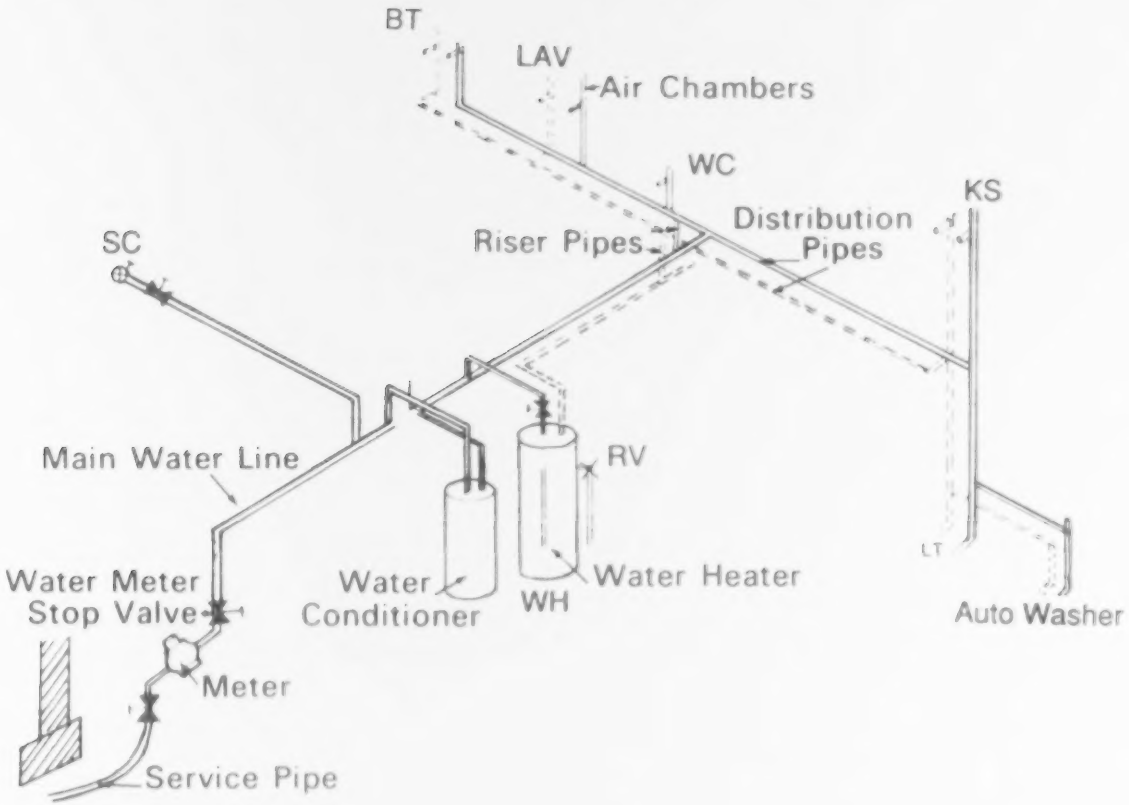
TM 1

Components of a Residential Water System (Continued)



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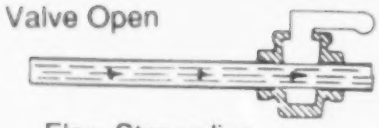
TM 2

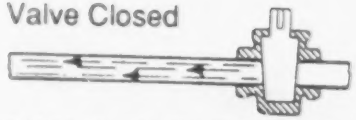
Water Hammer Arresters



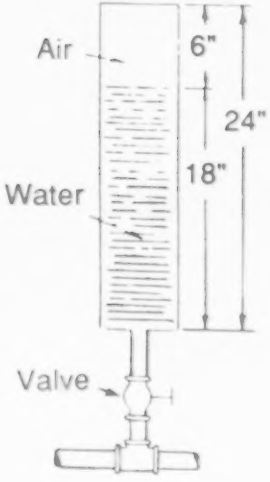
Flow Streamline

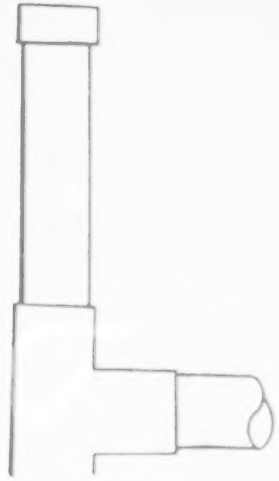
Increased Pressure Causes Pipe to Expand and Stretch

Chamber Present

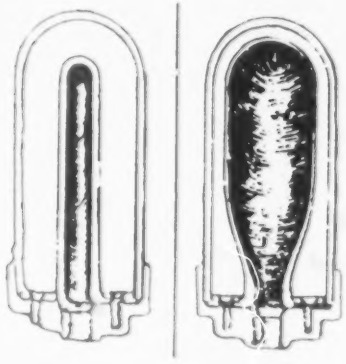


Pipe Returns to Its Original Shape and Size Forcing Water in Opposite Direction





Typical Air Chamber (Made from Pipe)



Patented Air Chambers

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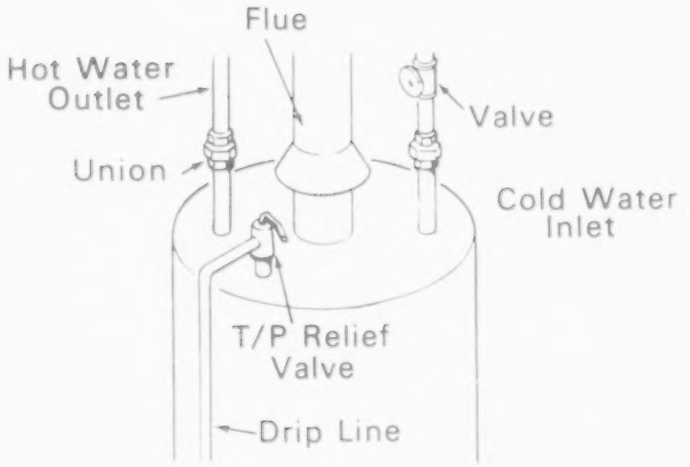
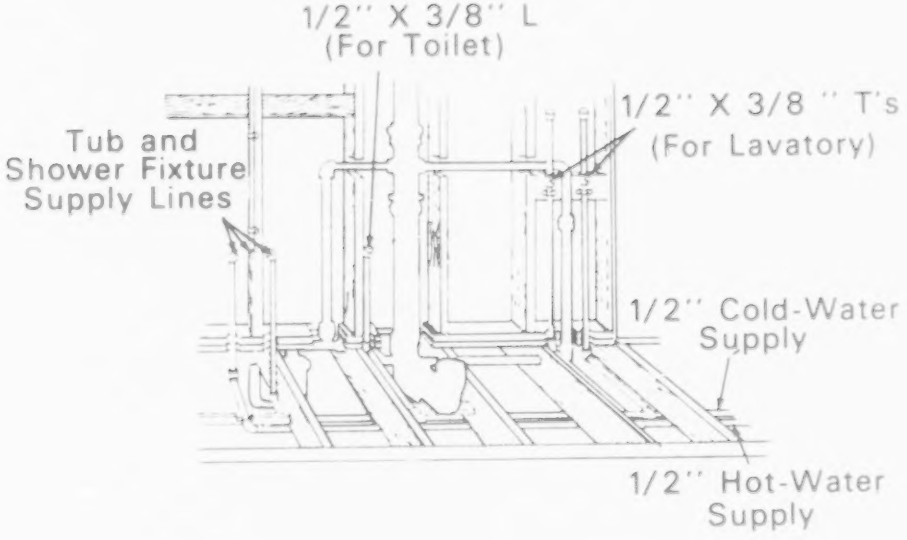
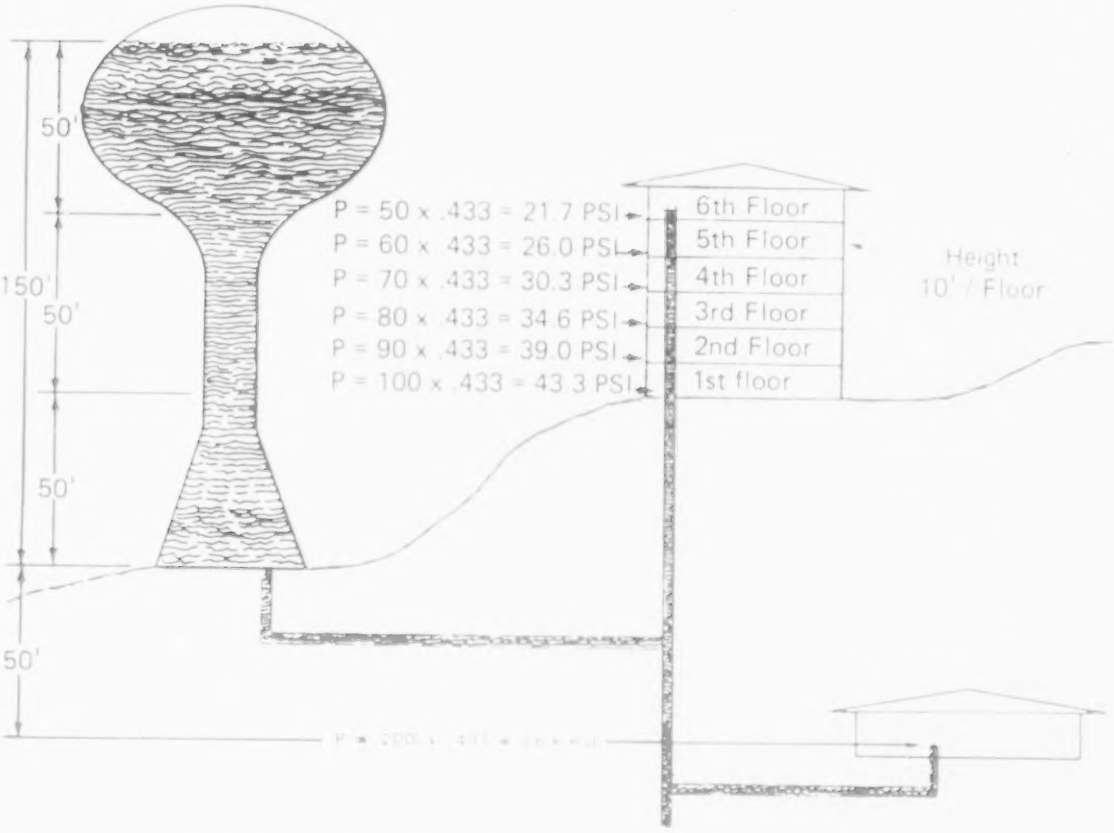
TM 3

Inlet and Outlet Pipe Sizing





Sizing of Pipe



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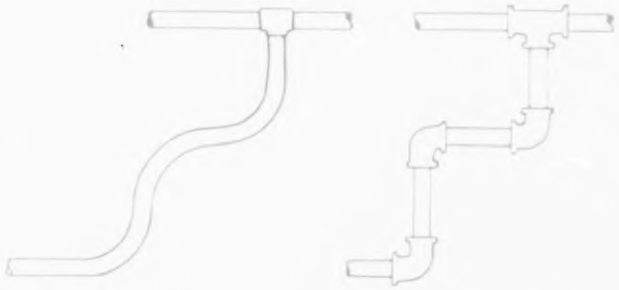
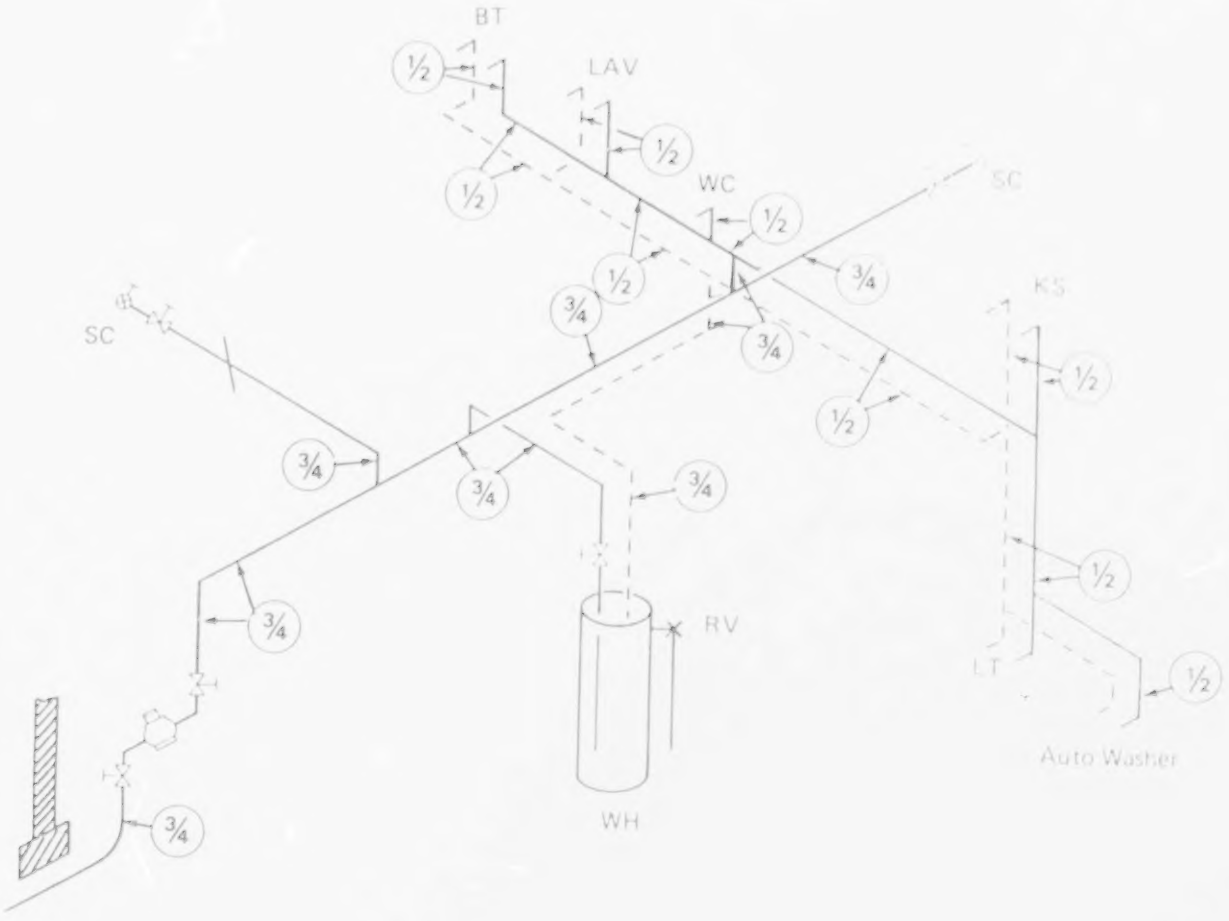


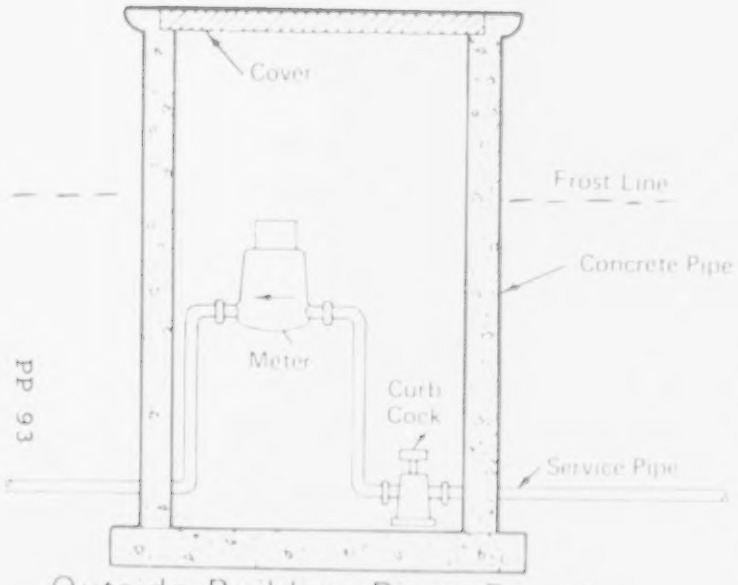
Less Water Flow Pressure in This Pipe

Copper Tube Galvanized Iron

Sizing of Pipe (Continued)



Prevention of Frozen Pipes



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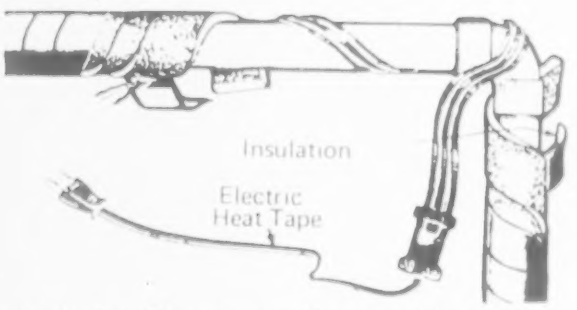
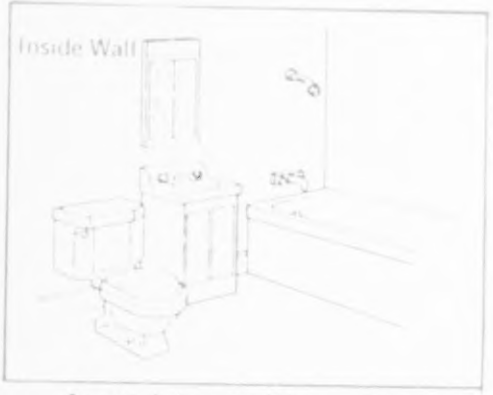
Outside Building Pipes Buried Below Frost Line

If Pipe is Installed in an Area Subject to Freezing, a Drain Valve Must Be Installed



Insulate Pipes in Crawl Space



Avoid Installing Pipes in Outside Walls

TM 7

MAKE AN ISOMETRIC DRAWING OF A HOT AND COLD SYSTEM FOR A TWO-STORY HOUSE

Directions: Show the following components on an isometric drawing of a hot and cold water system for a two-story house.

A. Service pipe with valves

B. Meter with valves

C. Laundry tray connections

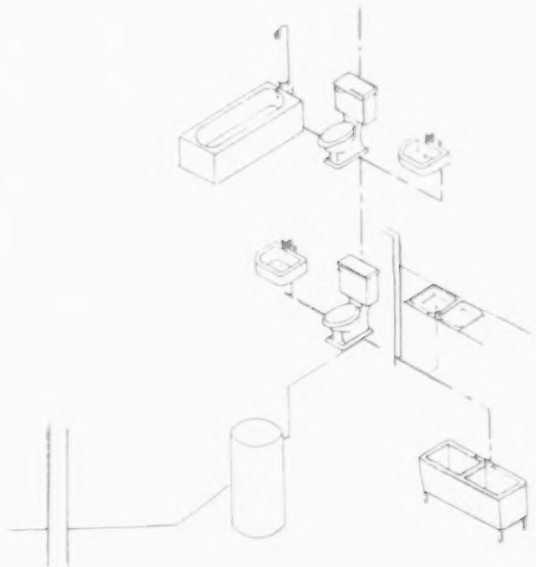
D. Water heater

E. Kitchen sink risers

F. Second floor bathroom risers

G. Bath, lavatory, and water closet distribution pipes

H. Air chambers for each bathroom fixture



Completion of this assignment sheet partially fulfills competency C-7 of Building Maintenance.

DETERMINE PIPE SIZES FOR A HOT AND COLD WATER SYSTEM FOR A TWO-STORY HOUSE

Directions: Using the hot and cold water system developed in AS 1, determine the pipe sizes needed for that system. The service pipe is 3/4".

A. Service pipe is 3/4" _____

B. Meter _____

C. Laundry tray _____

D. Water heater _____

E. Kitchen sink risers _____

F. Second floor risers _____

G. Second floor distribution pipe _____

H. Air chambers _____

ANSWERS TO ASSIGNMENT SHEETS 1 - 2

AS 1

Evaluated to the instructor's satisfaction

AS 2

Evaluated to the instructor's satisfaction

ROUGH-IN WATER SUPPLY LINES FOR BATHTUBS

Equipment:

Soldering equipment
Rough-in book
Tubing
Fittings and valves
Bath-shower valve
Pipe straps and nails
6' rule or steel tape
Pencil
Safety glasses

Procedure	Evaluation 3	2	1	N
1. Cut in and solder tee on main hot and cold water lines.				
2. Connect hot and cold water line for tub and shower bath to main line tees.				
3. Anchor over rim filler valve in bath wall at proper height and depth.				
4. Anchor and support tubing as necessary.				
5. Solder and anchor shower arm riser.				
6. Install shower arm.				
7. Cap shower rise and diverter lines.				
8. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.				
Average of above evaluations *				

*This average is the student's partial evaluation for competency C-7 of Building Maintenance.

ROUGH-IN WATER SUPPLY LINES FOR WATER CLOSETS

Equipment:

6' rule or steel tape
Pencil
Rough-in book
Soldering tools
Tubing
Fittings
Air chamber
Pipe straps and nails
Hammer
Drilling machine
Drill
Safety glasses

Procedure:

	Evaluation 3 2 1 N
1. Mark location of water supply line on a wall.	__ __ __ __
(Note: Normally, supply line is roughed-in 6" left of center of fixture.)	
2. Solder tee on main water supply line, if necessary.	__ __ __ __
3. Connect fixture supply branch to main supply tee.	__ __ __ __
4. Install air chamber on fixture supply line, if required.	__ __ __ __
5. Install supply line out of wall at correct height from floor.	__ __ __ __
(Note: Normally, tubing should protrude 6" out of wall.)	
6. Anchor and support supply line with pipe straps.	__ __ __ __
7. Cap end of fixture supply line.	__ __ __ __
8. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.	__ __ __ __
Average of above evaluations*	__ __ __ __

*This average is the student's partial evaluation for competency C-7 of Building Maintenance.

ROUGH-IN WATER SUPPLY LINES FOR WATER HEATERS

Equipment:

6' rule or steel tape
Soldering equipment
Tubing
Fittings and valves
Pipe straps and nails
Hammer
Safety glasses

Procedure:

		Evaluation 3	2	1	N
1.	Mark location of water supply line on wall.	__	__	__	__
2.	Cut in and solder tee on main supply line, if necessary.	__	__	__	__
3.	Connect fixture supply branch to main supply tee.	__	__	__	__
4.	Install supply line out of wall at correct height.	__	__	__	__
	(Note: Normally, tubing must protrude 6" out of wall.)				
5.	Anchor and support supply line as necessary.	__	__	__	__
6.	Cap end of fixture supply line.	__	__	__	__
7.	As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.	__	__	__	__
	Average of above evaluations*	__	__	__	__

*This average is the student's partial evaluation for competency C-7 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 3: WATER SYSTEMS

LESSON TEST

Part 1. Match the terms below to the correct definitions or descriptions.

A. Pressure head
B. Shut-off valve
C. Sill cock
D. Frost line
E. Friction loss

_____1. The depth of frost penetration in the soil

_____2. Amount of force or pressure created by the depth of one foot of water

_____3. A faucet on the outside of the building to which a garden hose can be attached

_____4. A full opening valve installed in the water line wherever a cut-off is required

_____5. Flow pressure loss caused by liquid coming in contact with the inside of the pipe

Part 2. Match the components of a water system in a single-family dwelling below to the correct functions.

A. Shut-off valve
B. Distribution pipes
C. Water meter
D. Water main
E. Curb stop
AB. Meter stop
AC. Air chamber
AD. Corporation stop
AE. Riser pipes
BC. Curb box
BD. Service pipe

_____6. A large pipe, buried in the street, which distributes water throughout the town or city

_____7. Water pipe which supplies water from the water main or other source of supply to the building served

_____8. Records amount of water consumed by residence or dwelling

_____9. A valve placed in the service line at or near the curb which permits easy control over the system

_____10. A cylindrical casting placed over the curb stop to allow remote opening and closing of the stop

_____11. Pipes which carry water from the service pipe to fixtures in the building

_____12. A valve installed between the street and the water meter

_____13. Pipes which rise vertically from a horizontal pipe

_____14. A valve installed in the water line wherever a cut-off is required

_____15. A closed section of pipe or coil, or a patented device designed to absorb shock caused by a rapidly closing valve or faucet; this prevents water-hammer and is installed at time of roughing in

_____16. A valve installed in the service pipe at the water main

Part 3. Select factors to consider when installing a hot water system by placing a "X" in the appropriate blanks.

_____17. Inlet pipe to the water heater must be at least as large as the outlet pipe

_____18. Hot water distribution pipes are equal in sizing and design to the cold water distribution pipe

_____19. Water heater is located according to source of cold water supply

_____20. Water heater is located according to source of fuel supply

_____21. Main hot water pipe should be larger in size than the main cold water pipe

Part 4. Select the true statements about sizing of pipes in residential water systems by placing an "X" to the left of the statements which are true.

_____22. Water pressure increases as the height of the water decreases

_____23. Distribution pipes vary in size according to their fixture application

_____24. Number and type of fittings affect water pressure

_____25. Water pressure is increased by friction loss caused by the water coming in contact with the inside of the pipe

_____26. Most town or city water supplies are disbursed from elevated tanks which distribute the water by gravity

_____27. A 1" column of water will create .433 lbs. per square inch of pressure at the base of the column

Part 5. Select the true statements about the prevention of frozen pipes in cold weather by placing an "X" to the left of the statements which are true.

_____28. Avoid installing pipes in outside walls

_____29. Outside building pipe lines must be buried above frost line

_____30. Avoid installing pipes in inside walls

_____31. Insulate pipes in crawl spaces

_____32. Install freeze-proof type hose bibs

_____33. If pipe is installed in a n area subject to freezing, avoid installing a drain valve

_____34. If in doubt, insulate or relocate pipes

_____35. Outside building pipe lines must be buried below the frost line

Part 6. Distinguish between materials used for pipes and materials used for valves in water pipe systems by placing a "P" to the left of the materials used for pipes and a "V" to the left of those used for valves.

(Note: Some materials may be used for both pipes and valves)

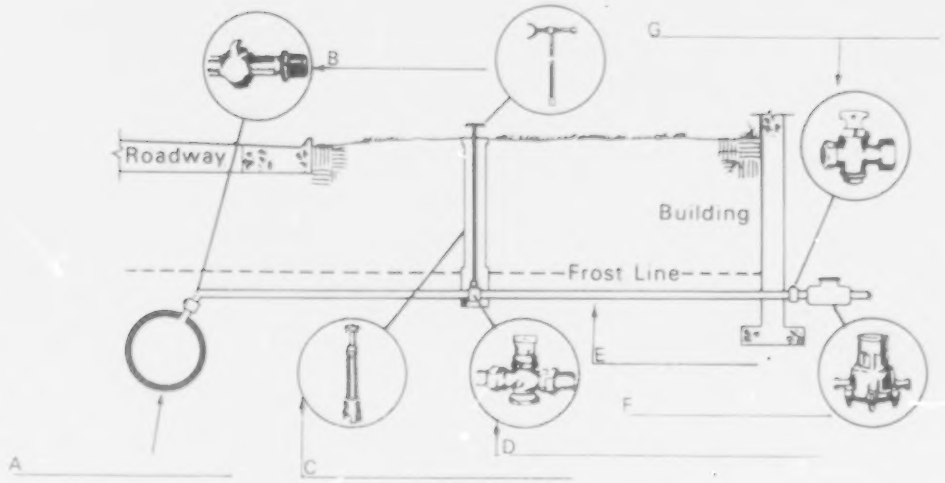
_____36. Brass

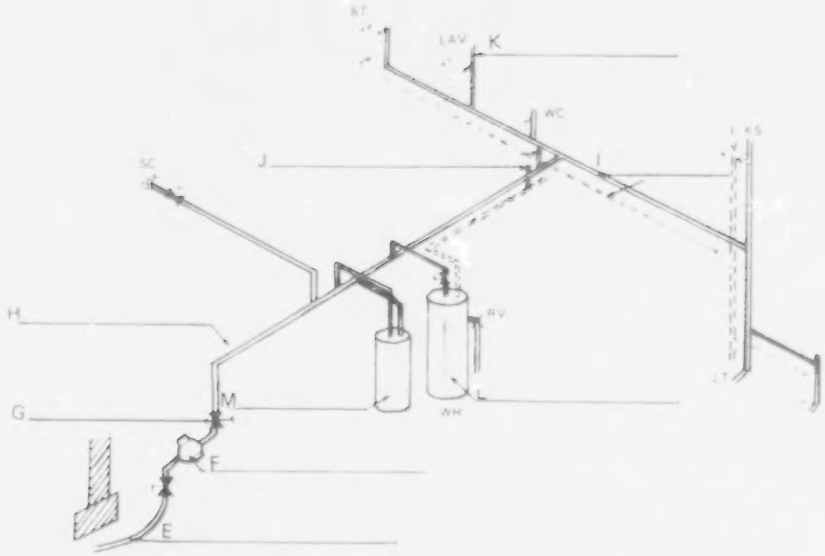
_____37. Plastic

_____38. Copper

_____39. Galvanized iron

Part 7. (40-52) Identify the following components of a water system in a single-family dwelling.





Part 8.

Make an isometric drawing of a hot and cold water system for a two-story house.

Part 9.

Determine pipe sizes for a hot and cold water system for a two-story house.

MODULE: PLUMBING PROCEDURES

ANSWERS TO UNIT I, LESSON 3 TEST

Part 1.

1.	D	2.	A	3.	C	4.	B	5.	E

Part 2.

6.	D	9.	E	12.	AB	15.	AC
7.	BD	10.	BC	13.	AE	16.	AD
8.	C	11.	B	14.	A		

Part. 3.

17.	X	19.	X	21.	
18.	X	20.	X		

Part 4.

22.		24.	X	26.	X
23.	X	25.		27.	X

Part 5.

28.	X	30.		32.	X	34.	X
29.		31.	X	33.		35.	X

Part 6.

36.	V	37.	P,V	38.	P	39.	P,V

Part 7.

40. (A) Water main (city main)
41. (B) Corporation coupling and valve
42. (C) Curb box
43. (D) Curb stop valve
44. (E) Service pipe
45. (F) Water meter
46. (G) Water meter stop valve
47. (H) Main water line
48. (I) Distribution pipes
49. (J) Riser pipes
50. (K) Air chambers
51. (L) Water heater
52. (M) Water conditioner

Part 8. Evaluated to the satisfaction of the instructor

Part 9. Evaluated to the satisfaction of the instructor

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 4: FIXTURES AND APPLIANCES

LESSON OBJECTIVE

After completion of this lesson, the student will be able to INSTALL VARIOUS TYPES OF FIXTURES AND APPLIANCES. Mastery will be evidenced by correctly performing the procedures outlined in the job sheets and by scoring _____ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms associated with fixtures and appliances to the correct definitions.
2. Identify the common fixtures and appliances used in residential plumbing.
3. Match fixtures and appliances with correct installation requirements.
4. Select true statements about the construction and materials used in the manufacture of common fixtures and appliances.
5. Install a water closet (floor mount).
6. Install a lavatory (wall hung type).
7. Install a bathtub (5' recessed).
8. Install shower bath accessories in a ceramic tile bathroom.
9. Install an electric heater.
10. Install a dishwasher.
11. Install a garbage disposal unit.
12. Install a gas water heater.

Completion of the requirements of this lesson fulfills competency C-8 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 4: FIXTURES AND APPLIANCES

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Water closets--bidets
   2. Lavatories
   3. Baths and showers
   4. Kitchen sinks
   5. Gas water heater
   6. Electric water heater
   7. Garbage disposers, dishwasher, laundry trays

D. Job sheets
   1. Install a water closet (floor mount)
   2. Install a lavatory (wall hung type)
   3. Install a bathtub (5' recessed)
   4. Install shower bath accessories in a ceramic tile bathroom
   5. Install an electric water heater
   6. Install a dishwasher
   7. Install a garbage disposer unit
   8. Install a gas water heater

E. Lesson test

F. Answers to lesson test

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 4: FIXTURES AND APPLIANCES

INFORMATION OUTLINE

I. Terms and definitions

A. Plumbing fixture--a receptacle for wastes which are ultimately discharged into the drainage system

B. Plumbing appliance--a special class of plumbing fixture intended to perform a special function

C. Backing--wood or other support placed in the building walls to which plumbing fixtures can be attached

D. Bathtub--water receptacle shaped to facilitate the entire body for bathing

E. Bidet--a low set bowl equipped with hot and cold running water which is used especially for bathing the internal and external genitals and posterior parts of the body

F. Dishwasher--an electric appliance for washing dishes

G. Drainage fixture unit (DFU)--a common measure of the probable discharge into the drainage system by various types of plumbing fixtures on the basis of one DFU being equal to 7.5 gallons per minute of discharge

(Note: The drainage fixture unit value for a particular fixture depends on its volume rate of drainage discharge, on the duration of a single drainage operation, and on the average time between operations)

H. Fixture drain--the drain from the trap of a fixture to the junction of that drain with any other pipe

I. Fixture supply--a water supply pipe connecting the fixture with the fixture branch pipe

J. Fixture branch--a water supply pipe between the fixture supply pipe and a water distribution pipe

K. Flood level rim--the top edge of plumbing fixture or receptacle from which the water overflows

L. Flush--to wash out with a large amount of water

M. Garbage disposer--an electric grinding device used with water to grind food wastes and discharge these wastes into the drainage system

N. Half-bath--a bathroom containing a water closet and lavatory

O. Kitchen sink--a shallow flat bottom fixture that is used in the kitchen for cleaning dishes and in the preparation of certain food

P. Laundry tray--a fixed tub installed in a laundry room of a home; it is supplied with cold and hot water and a drain connection, and is used for washing clothes and other household items

Q. Lavatory--a fixture designed for washing the hands and face; it is commonly found in bathrooms and restrooms

R. Three-quarter bath--a bathroom containing a water closet, lavatory, and a shower bath

S. Water closet--a water flushed plumbing fixture designed to receive human excrement directly from the user of the fixture

(Note: The term is sometimes used to describe the room or compartment in which the fixture is located)

T. Wall-hung--refers to a plumbing fixture which is supported from a wall

U. Vanity--a bathroom fixture consisting of a lavatory set into or onto the top of a cupboard or cabinet

V. Full bath--a bathroom containing a water closet, lavatory, and bathtub

II. Fixtures and appliances in residential plumbing (TM 1, TM 2, TM 3, TM 4, TM 5, TM 6, TM 7)

A. Water closets
1. Floor-set with close-coupled tank and bowl
2. One piece floor-set tank and bowl combination
3. Wall-hung siphon jet with close-coupled tank and bowl

B. Lavatories
   1. Self-rimming vanity lavatory
   2. Rim-type vanity lavatory
   3. Under-counter vanity lavatory
   4. Wall-hung lavatory

C. Baths
   1. Recessed bathtub
   2. Bath-shower modules

D. Shower baths
   1. Shower enclosures
   2. Shower bases

      (Note: Walls are built-in using a variety of materials)

E. Bidets

F. Kitchen sinks
   1. Self-rimming
   2. Rim-type

G. Water heaters
   1. Gas
   2. Electric

H. Garbage disposers

I. Dishwashers

J. Laundry trays
   1. Floor model
   2. Wall-hung model

III. Installation requirements for fixtures and appliances

(Note: Refer to local codes)

A. Water closets
   1. Rated at 6 DFU
   2. Requires a minimum of 3" for drain pipe
   3. Requires a minimum of 2" for vent pipe
   4. Has trap as an integral part of the fixture

      (Note: The trap is built into the water closet and needs no external additions)

   5. Has a built-in flushing device

      (Note: The built-in flushing device needs no external water fitting)

B. Lavatories
   1. Rated at 1 DFU
   2. Requires a minimum of 1 1/4" for drain pipe
   3. Requires a minimum of 1 1/4" for vent pipe
   4. Requires a trap connection to the waste pipe
   5. Requires a water fitting to deliver water into the lavatory

C. Bathtubs
   1. Rated at 2 DFU
   2. Requires a minimum of 1 1/2" for drain pipe
   3. Requires a minimum of 1 1/2" for vent pipe
   4. Requires a water fitting to deliver water into the tub
   5. Requires a trap and overflow connection to the waste pipe

D. Shower baths
   1. Rated at 2 DFU
   2. Requires a minimum of 2" for drain pipe
   3. Requires a minimum of 1 1/2" for vent pipe
   4. Requires a trap connection to the waste pipe
   5. Requires a water fitting to deliver water to the shower bath

E. Bidets
   1. Rated at 2 DFU
   2. Requires a minimum of 1 1/2" for drain pipe
   3. Requires a minimum of 1 1/4" for vent pipe
   4. Requires a trap connection to the waste pipe
   5. Requires a water fitting to deliver water to the nozzle
   6. Has vacuum breaker on water supply

F. Kitchen sinks
   1. Rated at 2 DFU
   2. Requires a minimum of 1 1/2" for drain pipe
   3. Requires a minimum of 1 1/2" for vent pipe
   4. Requires a trap connection to the waste pipe
   5. Requires a water fitting to deliver water to the sink

G. Water heaters
   1. Most common fuels are gas and electricity
   2. Usually constructed to heat and store water
   3. Usually constructed so the controls operate automatically

H. Garbage disposers
   1. Rated at 2 DFU

      (Note: This figure is usually not added to the unit load of the kitchen sink piping)

   2. Usually installed directed below the kitchen sink in place of the basket strainer
   3. Requires a trap connection to the waste pipe
   4. Requires kitchen sink water supply to provide adequate flushing of the drain
   5. Requires electrical connection

I. Dishwashers
   1. Rated at 2 DFU
   2. Requires a minimum of 1 1/2" for drain pipe
   3. Requires a minimum of 1 1/4" for vent pipe
   4. Most dishwashers use a built-in pump to discharge waste water
   5. Most dishwashers have built-in automatic water controllers
   6. Requires a trap connection to the waste pipe or disposer

J. Laundry trays
   1. Rated at 2 DFU
   2. Requires a minimum of 1 1/2" drain pipe
   3. Requires a minimum of 1 1/4" vent pipe
   4. Requires a fitting to deliver water to the laundry trays
   5. Requires a trap connection to the waste pipe

IV. Construction and materials used in the manufacture of fixtures and appliances

A. Water closets
   1. Water closets are made by casting clay, flintstone and other materials which, having been combined in a semi-liquid state, are poured into molds to produce vitreous china

      (Note: In the rough stage, the water closet is made in sections due to difficulty of casting the trap and flushing compartments in one piece)

   2. Water closets are glazed and fired in a kiln at high heat for up to three days to ensure strength and quality of finish
   3. Water closets are generally made in two sections- bowl and tank

(Note: Some models integrate the bowl and the tank into one casting)

4. Tanks are equipped with separately installed flushing mechanisms
5. Water closet seats are manufactured in colors to match the water closet

(Note: Water closet seats are constructed with closed front for residential use and open front for public use)

B. Lavatories
   1. Vitreous china
   2. Enameled cast iron
   3. Enameled pressed steel
   4. Stainless steel
   5. Plastic
   6. Fiberglass

C. Baths
   1. Materials
      a. Enameled steel
      b. Enameled cast iron
      c. Fiberglass
   2. Construction
      a. Bath bottoms should have a 1/8" per ft. pitch toward the drain
      b. Baths are available in various sizes, shapes and colors

(Note: Recessed tubs are the most common and are made in 4 1/2', 5', and 5 1/2' lengths)

      c. Height of the flood rim varies between 13" and 16"

D. Shower baths
   1. Materials
      a. Base
         i. Terrazzo
         ii. Fiberglass
         iii. Cast stone
         iv. Enameled steel
      b. Walls
         i. Fiberglass
         ii. Enameled steel
         iii. Glazed steel
         iv. Patented waterproof sheeting

2. Construction
   a. Sizes
      i. 30" x 30"
      ii. 36" x 36"
      iii. 36" x 48"
   b. Lead-pan sub bases are made on-the-job from sheet lead and can be made in any floor size necessary

E. Bidets
1. Bidets are made of vitreous china to afford clean washdowns

   (Note: Bidets are only intended for washing the body)

2. Bidets are usually located next to the water closet
3. The bidet is usually installed directly on the floor similar to a floor mounted water closet

F. Kitchen sinks
1. Material
   a. Enameled cast iron
   b. Enameled pressed steel
   c. Stainless steel
2. Available in various capacities
   a. Single well (compartment)
   b. Double well
   c. Triple well

G. Water heaters
1. Most water heaters are steel tanks with bonded glass linings intended to prevent corrosion of the tank

   (Note: Solar heaters are rapidly becoming popular)

2. Tank is insulated and covered with enameled steel jackets
3. Automatic controls are actuated by a thermostat

   (Note: Desired temperature can be predetermined by a manual control)

4. Water heaters are constructed with three pipe openings in the top
   a. Cold water inlet

      (Note: Also contains the dip tube which carries the cold water to the bottom of the tank)

b. Hot water outlet

(Note: Some water heaters incorporate magnesium anode rods into the hot water outlet to prevent electrolytic deterioration of the water heater)

c. Relief valve opening

(Note: Relief valves should be temperature-pressure actuated)

5. In the event that no opening is provided for a relief valve, most codes require that the valve be placed in the hot water line within six inches of the tank

(Note: Refer to local codes)

6. Water heaters are constructed with drain valves (boiler drains) at the bottom of the water tank
7. A drip line should extend from the relief/temperature valve to within 12" of the floor
8. Gas water heaters
   a. Need gas piping connections

   (Note: Some local codes allow flexible connectors at the heater)

   b. Need an exhaust flue to the outside atmosphere

   (Note: Flues should be as large as the exhaust outlet on the heater)

   c. Water heaters and furnaces may use the same chimney if the heat flue enters the chimney above the furnace flue

   (Note: Check for combustion error)

   d. Connecting directly to a furnace flue is permitted if a Y connection is used

   (CAUTION: Never use a T connection)

   e. Black iron pipe and fittings should be used for the pipe fitting
   f. A shutoff valve (gas cock) should be installed in the gas line close to the heater

g. A union should be installed close to the heater for easy installation and removal of heater
h. Manufacturer's instructions should be used for lighting and adjusting gas burners

9. Electric water heaters
   a. Need no flue connection
   b. Use an insulated heating element
   c. Some heaters have two heating elements
      i. Lower element for normal use
      ii. Upper element when larger amounts of hot water are required
   d. Heaters are wired for 240 volts
   e. Electrical work should be done by a licensed electrician

(CAUTION: Electrical connections should not be made until water heater has been filled with water)

H. Garbage disposers
   1. Four main components
      a. Electric motor
      b. Grinding chamber
      c. Two grinding elements
         i. Rotating shredder
         ii. Stationary grind ring
      d. Sink fitting
   2. Operates on 120 volts
   3. Made of stainless steel, plastic or other materials
   4. Easily installed in place of sink basket strainer and tailpiece

(Note: Follow specific manufacturer's instructions for installation)

   5. Most disposers have a dishwasher drain connection

I. Dishwashers
   1. Self-contained units which need water and waste connections

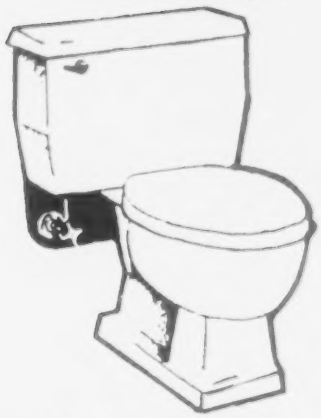
(Note: Follow specific manufacturer's instructions for installation)

   2. Many types and models manufactured using various methods, design, and materials

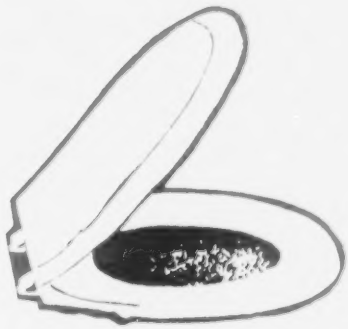
(Note: Plumbers should become acquainted with various models offered by manufacturers)

J. Laundry trays
   1. Most are made of fiberglass, cast iron, or plastic
   2. Double compartment and single compartment models are available
   3. Floor models (with legs) and wall-hung models are available

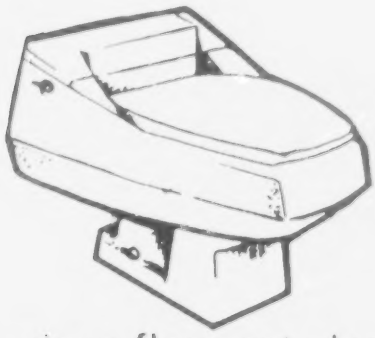
Water Closets-Bidets



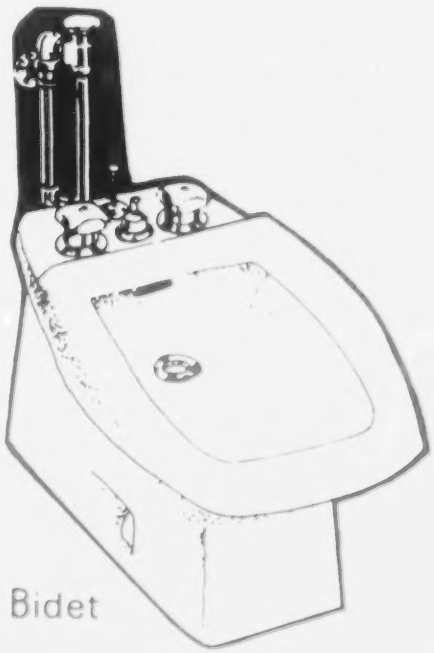
Floor set closet with close-coupled tank and bowl.



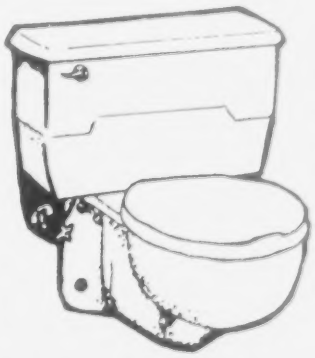
Closed front seat and cover.



One-piece floor set closet tank and bowl combination.



Bidet



Wall-hung siphon jet water closet with a close-coupled tank and bowl

PP 129

Lavatories

Under-Counter
Vanity Lavatory

Rim-Type
Vanity Lavatory

Self-Rimming
Vanity Lavatory

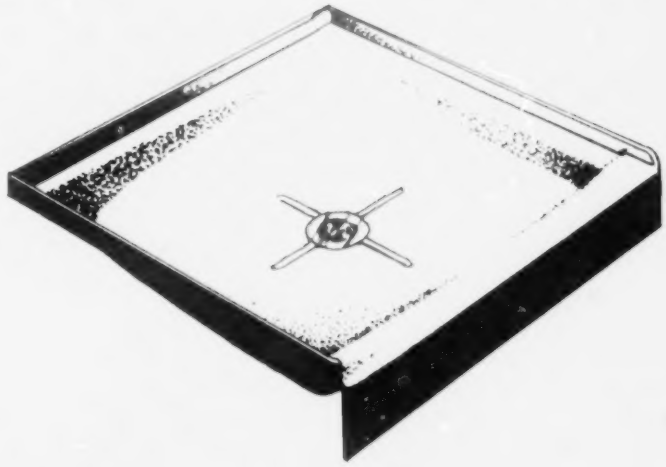
Wall Hung Lavatory
with Raised Back

PP 131

TM 2

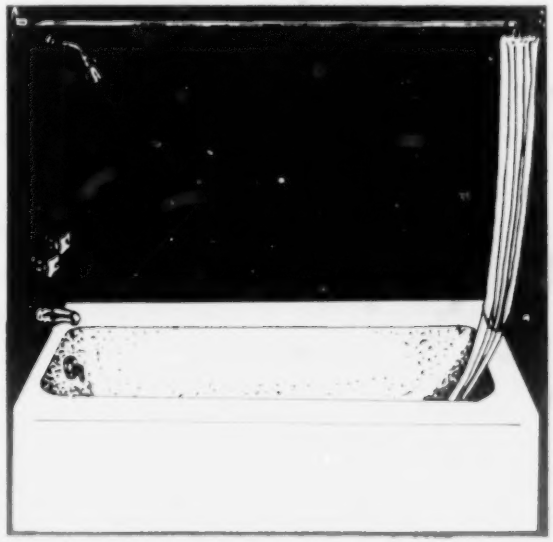
Baths and Showers

Bath-shower Module



Fiberglass Shower Base

One-piece Fiberglass Shower Enclosure

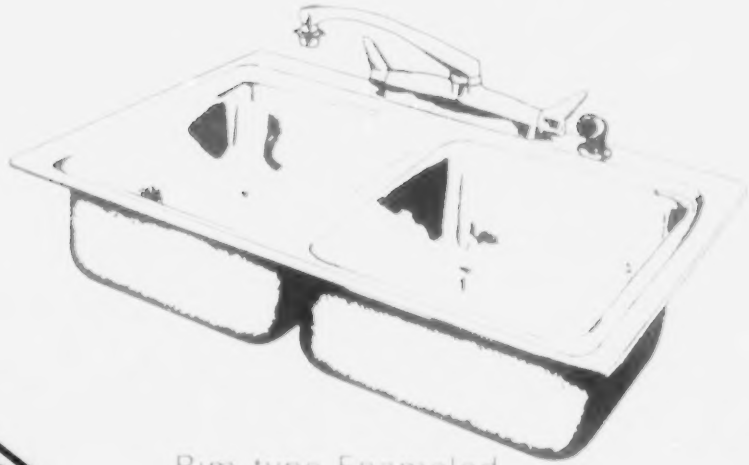


Recessed Bathtub

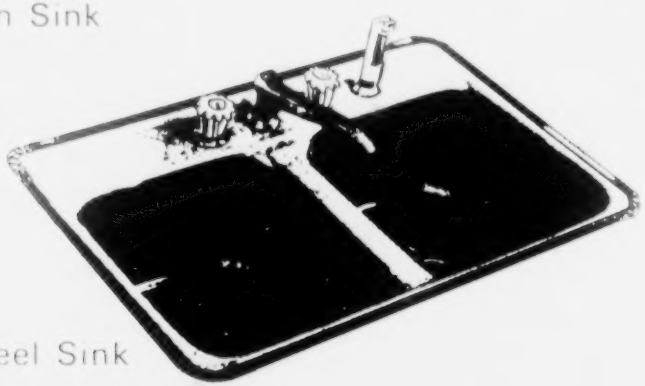
Kitchen Sinks

PP 135

Self-rimming Enameled
Cast Iron Sink



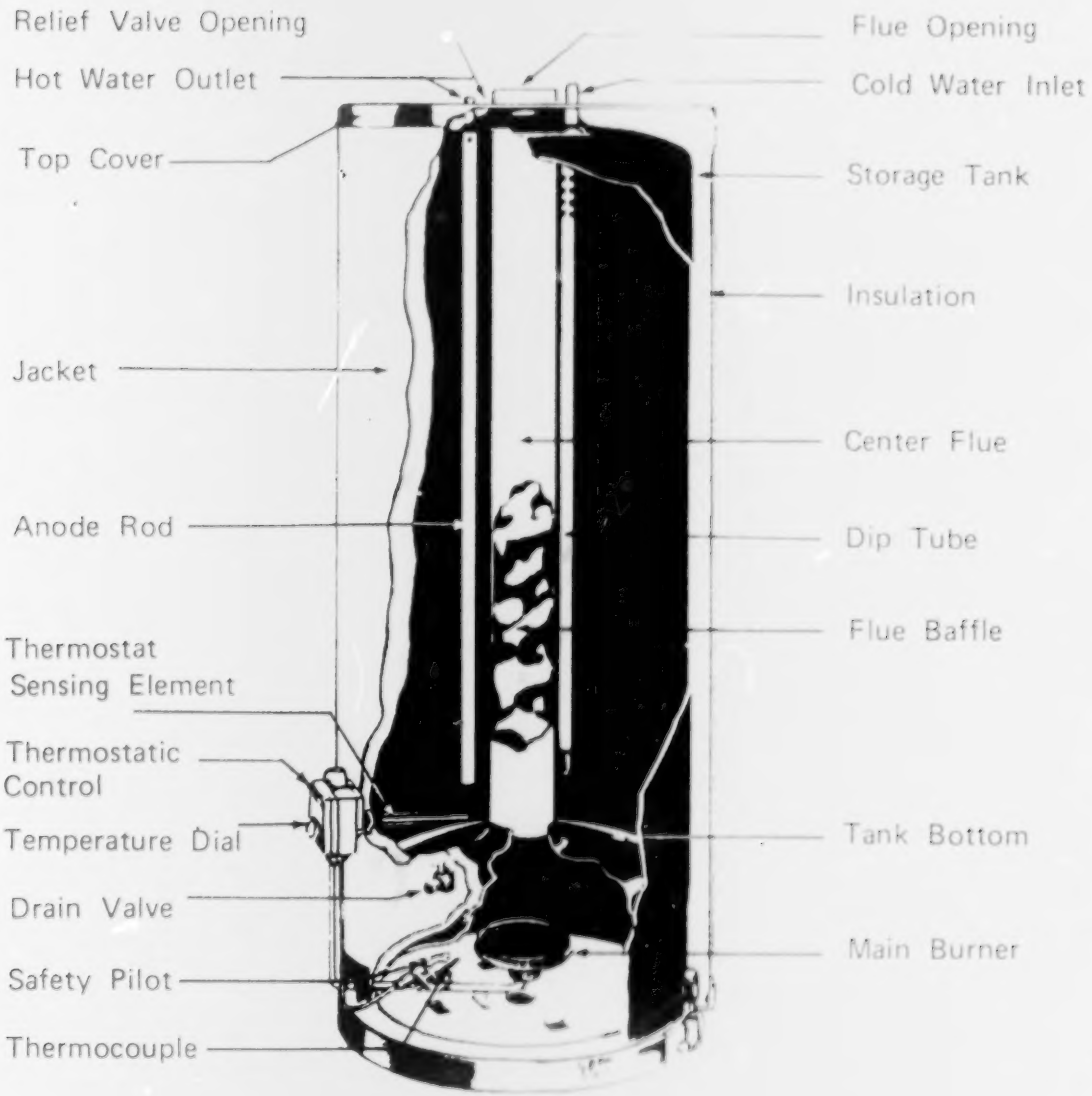
Rim-type Enameled
Cast Iron Sink



Stainless Steel Sink

TM 4

Gas Water Heater



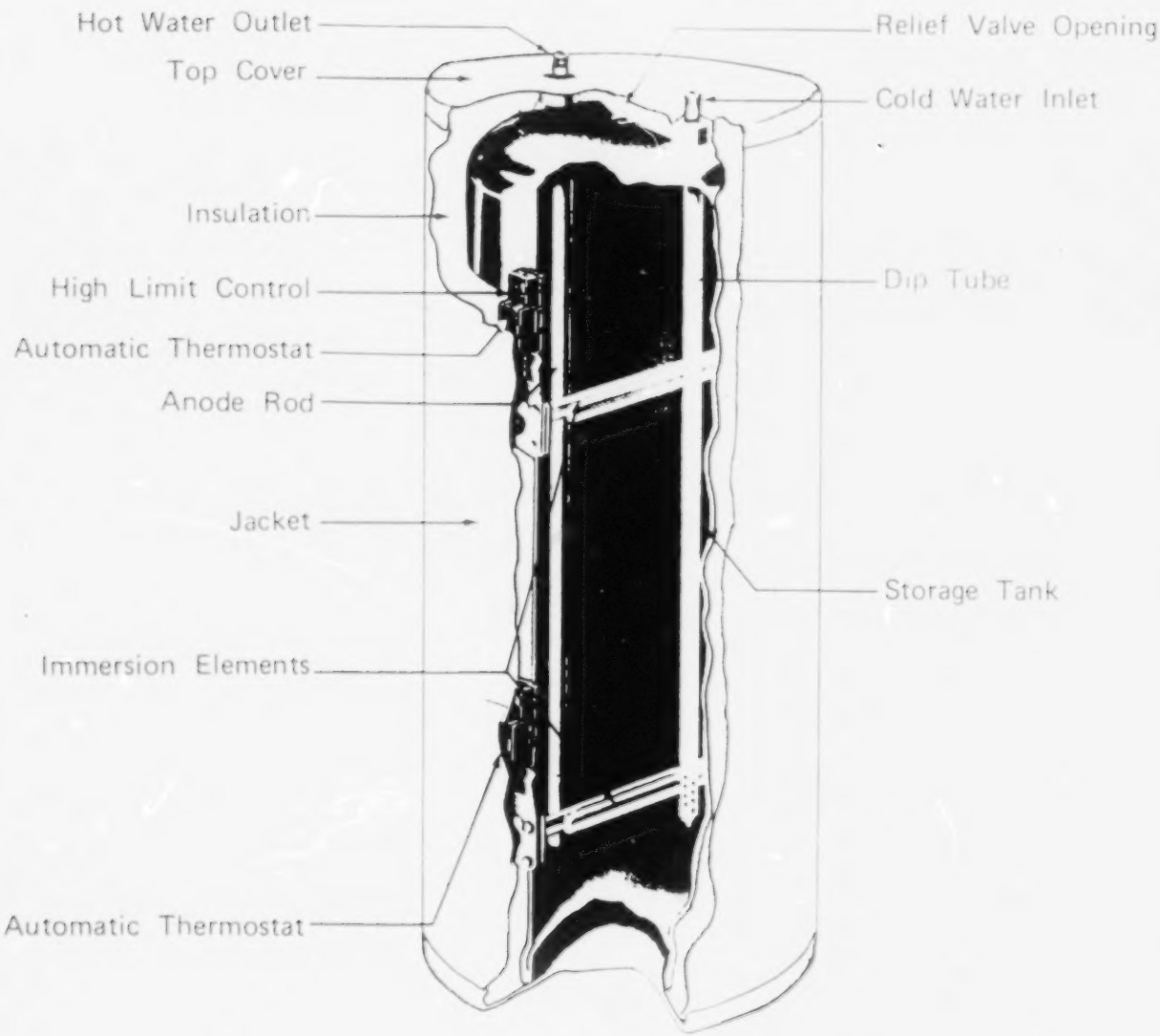
Sectional View of an

Automatic Gas Storage Tank Water Heater

(A.O. Smith)

PP 137

Electric Water Heater

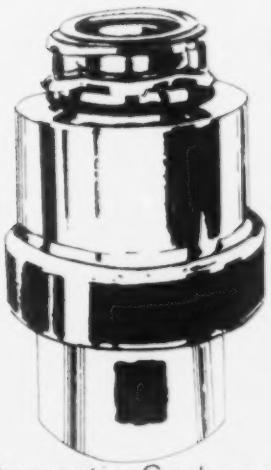


Sectional View Of an Automatic
Electric Storage Tank Water Heater

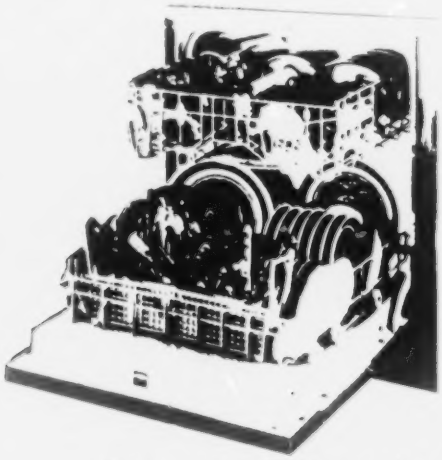
(A. O. Smith)

PP 139

Garbage Disposers, Dishwashers, Laundry Trays



Domestic Garbage Disposal



Domestic Dishwasher

Floor Model Double Compartment Laundry Tray

Wall-Hung Double Compartment Laundry Tray

INSTALL A WATER CLOSET (FLOOR MOUNT)

Equipment:

Wax seal
6 ft. ruler
Pencil
Cloth or rag
Hacksaw (jab saw type preferred)
Tubing cutters
8" adjustable wrench
Pipe joint compound
Large straight screwdriver
Socket wrench or water closet seat wrench
Necessary tools to install closet flange--soldering outfit--caulking tools--or plastic pipe tools
2' level
Drop cloth
Safety glasses
Water closet (complete bowl and tank)
Water closet seat
Closet bolts (with bolt caps)
Closet supply pipe with angle valve)
(Note: Determine type of pipe connection before acquiring closet supply.)
Closet flange (w/screws if wood floor) Socket wrench or water

Procedure:

	Evaluation 3	2	1	N
1. Gather all tools and equipment and carry to the work site.				
2. Install the water supply angle valve.				
3. Install the water closet flange on the soil pipe if not previously done.				
4. Remove wax seal from wrapper or carton and place on water closet bowl.				
(Note: Place firmly to avoid having the seal move when positioning the water closet bowl.)				
5. Position the closet bolts in the closet flange.				

6. Carefully life water closet bowl, turn right side up, and place over closet flange centering bolt holes over bolts.

7. With a slight rocking motion, force the bowl down on the wax seal until the bowl sets evenly on the floor.

   (Note: In cold weather, the wax ring may have to be warmed before installation.)

8. Check the bolt caps and if any clips are necessary on the bolts, install them now.

9. Place washers and nuts on bolt ends and hand tighten.

10. Place a level on the bowl (parallel to the back wall) and tighten bolts.

11. Remove water closet tank from carton.

    (Note: Check for missing parts.)

12. Place washers on tank bolts and insert down through bolts.

    (Note: Check parts list for correct and complete assembly.)

13. Straddle the water closet bowl and carefully place tank on bowl, allowing the bolts to enter the bolt holes in the bowl.

14. Hold bolt heads (usually provided with screwdriver slot) with one hand and place washer and nut on end of each bolt.

    (Note: Set on bowl facing tank.)

15. With large screwdriver, hold bolt heads (in tank) and tighten nuts (under tank) with adjustable wrench or socket wrench.

    (Note: Place level on top of tank and adjust bolts accordingly.)

16. Measure and cut the water supply tube.

    (Note: Allow for any bends needed.)

a. Hand tighten the supply tube to the ballcock shank.

b. Make necessary bends.

c. Determine length of supply tube and make scratch mark.

d. Remove supply tube and cut to desired length.

17. Install the water supply tube using a small amount of pipe joint compound on threaded connections; this acts as a lubricant and creates a tighter joint.

(Note: Hold ballcock with one hand while tightening shank connection.)

18. If not previously done, secure angle valve in final position.

(Note: This may be soldered, compression jointed, or threaded.)

19. Install seat, using socket wrench or W.C. seat wrench.

20. Check closet bolts (flange) for tightness.

21. Cut closet bolts off to desired height and install bolt caps.

22. Check tank bolts for tightness.

23. Turn on water and check for leaks.

a. Packing gland on angle valve.

b. Under tank.

c. Supply tube.

d. Base of bowl.

24. Adjust float arm for desired water level.

(Note: If required, grout the base of the water closet bowl.)

25. Have instructor check your work.

26. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.

Average of above evaluations*

*This average is the student's partial evaluation for competency C-8.

INSTALL A LAVATORY (WALL HUNG TYPE)

Equipment:

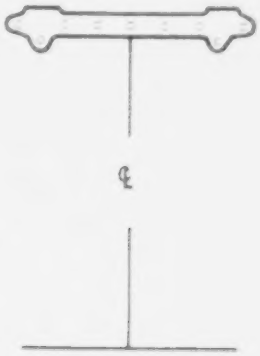
6' ruler
Pencil
2' level
Hand drilling machine
3/8" masonry drill
3/16" twist drill
Basin wrench
8" adjustable wrench
Tubing cutters: 1/2", 1 1/2"
Pipe joint compound
Medium size screwdriver
Spud wrench or all purpose wrench
Plug wrench
6 wood screws
1 1/2 P-trap (chrome plated brass tube, 17 gauge)
Faucet (complete and with drain plug)
Set of flexible supply tubes with angle valves
Lavatory (wall hung type)
Grout
Safety glasses

Procedure:

		Evaluation 3	2	1	N
1.	Gather all tools and equipment and carry to the work site.				
2.	Make sure the wall and floor of the work area are clean.				
3.	Lay out tools in an orderly fashion and within easy reach.				
4.	Take lavatory out of carton and make sure wall hanger is not missing.				
	(Note: Use care in handling. Scratches could mean replacing the lavatory.)				

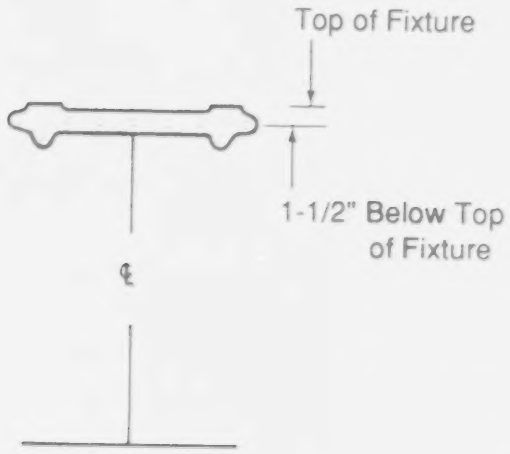
5. On bathroom wall, determine and lightly mark exact location (center line) of installation.

(Note: Center line of lavatory is usually--but not always--directly above drain stub.)



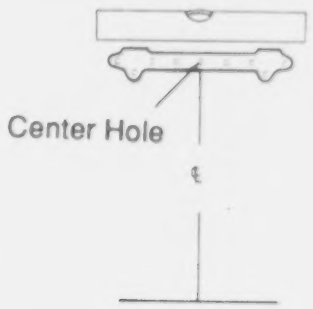
6. Determine hanger height from floor.

(Note: This measurement is sometimes provided on manufacturer's rough-in sheets.)



7. Hold the hanger on the wall at the proper height and locate center screw hole on vertical center line.

(Note:; Level the hanger with the 2' level.)

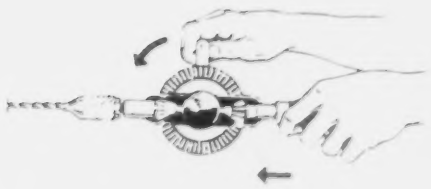


8. Mark proposed screw locations on the wall.

9. Remove hanger.

(Note: Accuracy in drilling holes is important.)

10. Start holes in glazed tile by chipping the glaze off with a nail set.



11. Drill screw starter holes. _ _ _ _ _

(Note: Tile and cement walls should be drilled with a masonry drill and wood backing should be drilled with a twist drill. If wood backing has not been installed, nylon anchors, molly bolts or toggle bolts are acceptable in some cases. Usually legs are provided for the lavatory in such cases.)

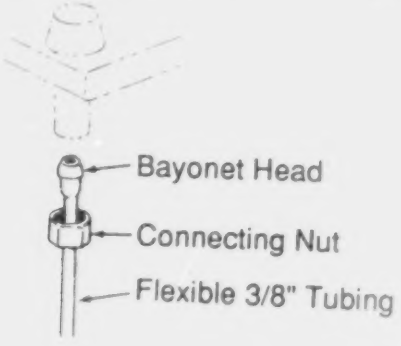
12. Install the faucet and drain plug according to manufacturer's instructions. _ _ _ _ _

13. Place lavatory on hanger, lightly tap downward with the heel of the hand, and check with a 2' level. _ _ _ _ _

(Note: Lavatory should seat firmly on the hanger.)

14. Install water supply angle valve. _ _ _ _ _

15. Connect supply tube to faucet shank (hand tight). _ _ _ _ _



16. Make necessary bends in supply tube and make scratch mark at desired length. _ _ _ _ _

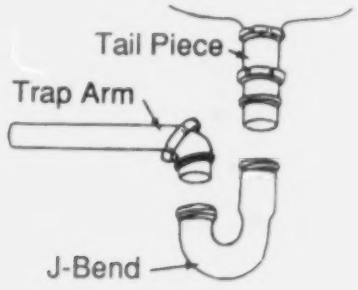
(Note: Check for fitting allowance in the angle valve.)

17. Remove supply tube and cut to desired length. _____

18. Place shank and angle valve nuts on supply tube and secure tube in position. _____

(Note: A basin wrench is necessary to make a tight connection on the shank end.)

19. Install trap. _____



20. Have instructor check your work. _____

21. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _____

Average of above evaluations* _____

*This average is the student's partial evaluation for competency C-8.

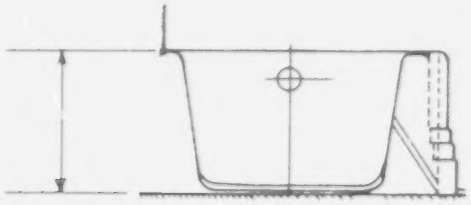
INSTALL A BATHTUB (5' RECESSED)

Equipment:

Bathtub (recessed, 5')
Tub waste and overflow
Trap
1" x 4" x 4' lumber
Newspapers or other tub protection material
6' ruler
Pencil
Long-handled broom
Handsaw
Hammer
Nails (approximately 1 dozen, 10d or 16d)
Safety glasses

Procedure:

		Evaluation 3	2	1	N
1.	Gather all tools and equipment and carry to the worksite.				
2.	Sweep out the tub space.				
	(Note: All trash should be removed and the floor made clean and smooth.)				
3.	Uncrate the tub being careful not to cause scratches.				
	(Note: On cast iron tubs, two men should handle the installation.)				
4.	Determine the distance from the floor to the underside of the rear ledge.				
	(Note: This measurement is usually not given on manufacturer's specifications.)				



Tub-End View

5. Pencil mark this distance on each end stud of the back wall. _____

   (Note: Measure vertically, from the floor.)

6. If necessary, cut 1" x 4" lumber to fit tub opening. _____

7. Nail 1" x 4" lumber across studs, using the pencil mark as the upper edge. _____

   (Note: The 1" x 4" ledge now represents the distance from floor to the underside of the rear ledge of the tub.)

8. Carefully bring the tub into the tub space and rest the rear ledge on the 1" x 4" support. _____

9. Level the tub (length and width) using vinyl shims if necessary. _____

   (Note: The tub should rest firmly on the ledge and the floor.)

10. If made of enameled steel, secure the tub to the rear studs with shingle nails. _____

    (Note: Cast iron tubs need not be fastened down.)

11. Completely cover the tub with protective materials. _____

    (Note: The bathroom may not be finished for weeks after this installation, and because of the large number of workers in the building, damage could occur to the tub if not protected.)

12. Have instructor check your work. _____

13. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _____

Average of above evaluations* _____

***This average is the student's partial evaluation for competency C-8.**

INSTALL SHOWER BATH ACCESSORIES IN A CERAMIC TILE BATHROOM

Equipment:

Strap wrench
Pipe compound
Safety glasses
Phillips head screwdriver
Shower bath accessories
Clean cloth
Pipe wrench

Procedure:

		Evaluation 3	2	1	N
1.	Gather all tools and equipment and carry to job site.	_	_	_	_
	(Note: Protect the tub from possible damage due to falling tools.)				
2.	Remove test nipple and cap from shower pipe elbow using pipe wrench.	_	_	_	_
3.	Connect shower head and arm and slide escutcheon over arm.	_	_	_	_
4.	Apply pipe compound to threaded portion of shower arm and install arm in shower pipe elbow.	_	_	_	_
	(Note: Tighten only with strap wrench to avoid scratching chrome finish.)				
5.	Move escutcheon to fit tightly to wall.	_	_	_	_
6.	Remove protective coverings from bath-shower valves.	_	_	_	_
7.	Install escutcheons and valve covers.	_	_	_	_
	(Note: Keep escutcheons tight to wall.)				
8.	Install valve handles, tightening screws with screwdriver.	_	_	_	_
9.	Snap on screw-head covers.	_	_	_	_
10.	Wipe valves and tub with clean cloth.	_	_	_	_
11.	Have instructor check your work.	_	_	_	_

12. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _____

Average of above evaluations* _____

*This average is the student's partial evaluation for competency C-8 of Building Maintenance.

INSTALL AN ELECTRIC WATER HEATER

Equipment:

Tubing cutter with reamer
Tank wrench
Flux
Adjustable wrench
Tubing
Relief valve
1 3/4" male adapters
Safety glasses
Striker
Solder
Sand cloth
Air-acetylene torch
Fittings as needed
Water heater
1 3/4" gate valve

Procedure:

		Evaluation 3	2	1	N
1.	Gather all tools and equipment and carry to the job site.				
2.	Remove water heater from the carton.				
3.	Assemble soldering tools and solder 2, 3/4" male adapters onto 2, 8" pieces of 3/4" copper tubing.				
	(Note: Allow to cool thoroughly before installing in tank.)				
4.	Apply pipe compound to threaded portion of relief valve and install valve in heater.				
	(Note: Location is usually marked.)				
5.	Install tubing from relief valve to within 12" of the floor.				
	(Note: See local code.)				
6.	Position heater in proper place for installation.				
	(Note: Electric elements must be accessible.)				
7.	Apply pipe compound/tape to 3/4" male adapters and install in inlet and outlet openings using adjustable wrench.				
	(Note: Check local codes for reference to dielectric unions.)				

8. Clean and flux 3/4" valve and tubing ends protruding from 3/4" male adapters. _____

9. Install 3/4" valve on cold water inlet tubing. _____

10. Clean and flux tubing for cold and hot water connections. _____

11. Install tubing and make soldered connections. _____

    (Note: Open valve before soldering.)

12. Close drain valve. _____

13. Open hot water faucet on nearest fixture. _____

14. Open cold water inlet valve on water heater. _____

    (Note: When water runs freely from fixture faucet, close inlet valve.)

15. Check for leaks. _____

    (Note: When heater is first turned on, condensation may appear on the floor under the heater.)

16. Have instructor check your work. _____

17. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _____

Average of above evaluations* _____

***This average is the student's partial evaluation for competency C-8 of Building Maintenance.**

INSTALL A DISHWASHER

Equipment:

Air-acetylene torch
Striker
Gas tank
Tank wrench
Solder
Flux
Sand cloth

Adjustable wrench
Flaring tool and block
Flare nut wrench

Level
Screwdriver
1/2" tubing cutters
1 1/2" tubing
Tubing
Fittings and valves
Dishwasher adapter sink tailpiece
6' rule or steel tape
Clean cloth
Safety glasses

Procedure:

		Evaluation 3	2	1	N
1.	Remove front cover from dishwasher using screwdriver.	_	_	_	_
2.	Place dishwasher in position in the cabinet.	_	_	_	_
3.	Locate water inlet and outlet in the cabinet.	_	_	_	_
4.	Using adjustable wrench, install unions on inlet and outlet connections.	_	_	_	_
	(Note: Dishwashers must be able to be disconnected in order to be removed easily.)				
5.	Shut off hot water supply to kitchen sink and drain the line.	_	_	_	_
6.	Cut into hot water line under sink and install tee and valve to dishwasher.	_	_	_	_
7.	Run line from valve to water inlet on dishwasher and solder all connections.	_	_	_	_
	(Note: Check manufacturer's specifications.)				
8.	Remove tailpiece from sink drain nearest dishwasher and replace with dishwasher adapter tailpiece using spud drain.	_	_	_	_

9. Measure and cut 1/2" copper tubing to fit from drain union of dishwasher to adapter tailpiece on sink drain. _ _ _ _ _

   (Note: Check manufacturer's specifications for drain loop to prevent sink backup into dishwasher.)

10. Clean and flux all connections. _ _ _ _ _

11. Install tubing and solder connections. _ _ _ _ _

12. Turn water on and check for leaks. _ _ _ _ _

    (Note: Electrician must connect electricity in order to check all connections.)

13. Check manufacturer's instructions for securing dishwashers to cabinet and leveling legs. _ _ _ _ _

14. Replace front cover. _ _ _ _ _

15. Have instructor check your work. _ _ _ _ _

16. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _ _ _ _ _

Average of above evaluations* _ _ _ _ _

*This average is the student's partial evaluation for competency C-8 of Building Maintenance.

INSTALL A GARBAGE DISPOSER UNIT

Equipment:

Pipe compound
2" tubing cutter
Safety glasses
Adjustable spud wrench or all-purpose wrench
Strainer wrench
Garbage disposer

Procedure:

		Evaluation 3	2	1	N
1.	Gather all tools and equipment and carry to the job site.				
2.	Remove garbage disposer unit from carton and read manufacturer's instructions.				
3.	Remove sink tailpiece using adjustable spud wrench.				
4.	Loosen basket strainer in sink using strainer wrench.				
5.	Position disposer unit under sink drain.				
6.	Screw basket strainer into top of disposal unit and tighten lock nut using strainer wrench.				
7.	Install continuous waste drain into disposal unit and tighten slip joints with adjustable spud wrench.				
	(Note: Use a directional (venturi) tee in the continuous waste drain.)				
8.	Install trap between disposal unit and waste drain and tighten slip joints with adjustable spud wrench.				
9.	Turn on the water into sink and check for leaks.				
10.	Have instructor check your work.				
11.	As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.				
	Average of above evaluations*				

***This average is the student's partial evaluation for competency C-8 of Building Maintenance.**

INSTALL A GAS WATER HEATER

Equipment:

Water heater
Relief valve
Pipe
Fittings and valves
Vent pipe
Pipe vise
Pipe cutter
Pipe threader
Oil can
Black iron pipe
Gas pipe fittings and valves
Drop cloth
Safety glasses
Reamer

Procedure:

		Evaluation 3	2	1	N
1.	Locate relief valve outlet on water heater.	_	_	_	_
2.	Install relief valve.	_	_	_	_
3.	Attach 3/4" approved line from relief valve to location of desired overflow.	_	_	_	_
	(Note: End of line must not be threaded)				
4.	Using nipple, elbow and union, install 3/4" galvanized line from heater to cold water supply line.	_	_	_	_
5.	Using nipple, elbow and union, install 3/4" galvanized line from heater to hot water supply line.	_	_	_	_
6.	Using 3" galvanized vent pipe, run vent into chimney.	_	_	_	_
7.	Using black iron pipe and fittings required, connect gas line to heater.	_	_	_	_
8.	Turn gas supply on and check for leaks, using soap and water solution as a leak detector.	_	_	_	_
9.	Open hot water faucet in kitchen sink.	_	_	_	_
10.	Turn water supply on.	_	_	_	_
11.	Fill hot water tank until water flows from hot water faucet in kitchen sink.	_	_	_	_
12.	Light and adjust burner.	_	_	_	_

13. Have instructor check your work. _____

14. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _____

Average of above evaluations* _____

*This average is the student's partial evaluation for competency C-8 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 4: FIXTURES AND APPLIANCES

LESSON TEST

Part 1A. Match the terms below to the correct definition.

A. Fixture drain
B. Bathtub
C. Plumbing fixture
D. Fixture branch
E. Bidet
AB. Dishwasher
AC. Plumbing appliance
AD. Fixture supply
AE. Backing
BC. Drainage fixture unit DFU
BD. Flood level rim

_____1. A receptacle for wastes which are ultimately discharged into the drainage system

_____2. A special class of plumbing fixture intended to perform a special function

_____3. Wood or other support placed in the building walls to which plumbing fixtures can be attached

_____4. A water receptacle shaped to facilitate the entire body for bathing

_____5. A low-set bowl equipped with hot and cold running water, which is used especially for bathing the internal and external genitals and posterior parts of the body

_____6. An electric appliance for washing dishes

_____7. A common measure of the probable discharge into the drainage system by various types of plumbing fixtures on the basis of one DFU being equal to 7.5 gallons per minute of discharge

_____8. The drain from the trap of a fixture to the junction of that drain with any other pipe

_____9. A water supply pipe connecting the fixture with the fixture branch pipe

_____10. A water supply pipe between the fixture supply pipe and a water distribution pipe

_____11. The top edge of plumbing fixture or receptacle from which the water overflows

Part 1B. Match the terms below to the correct definitions or descriptions.

A. Half-bath
B. Three-quarter bath
C. Vanity
D. Flush
E. Wall-hung

AB. Kitchen sink
AC. Lavatory
AD. Garbage disposal
AE. Water closet
BC. Laundry tray
BD. Full bath

_____12. To wash out with a large amount of water

_____13. An electric grinding device used with water to grind food wastes and discharge these wastes into the drainage system

_____14. A bathroom containing a water closet and lavatory

_____15. A shallow flat bottom fixture that is used in the kitchen for cleaning dishes and in the preparation of certain food

_____16. A fixed tub installed in a laundry room of a home; it is supplied with cold and hot water and a drain connection, and is used for washing clothes and other household items

_____17. A fixture designed for washing the hands and face; it is commonly found in bathrooms and restrooms

_____18. A bathroom containing a water closet, lavatory, and a shower bath

_____19. A water flushed plumbing fixture designed to receive human excrement directly from the user of the fixture

_____20. Refers to a plumbing fixture which is supported from a wall

_____21. A bathroom fixture consisting of a lavatory set into or onto the top of a cupboard or cabinet

_____22. A bathroom containing a water closet, lavatory, and bathtub

Part 2. Match fixtures and appliances with correct installation requirements.

A.	Water closets	AB.	Kitchen sinks
B.	Lavatories	AC.	Water heaters
C.	Bathtubs	AD.	Garbage disposers
D.	Shower baths	AE.	Dishwashers
E.	Bidets	BC.	Laundry trays

_____23.
a. Rated at 2 DFU
b. Requires a minimum of 1 1/2" for drain pipe
c. Requires a minimum of 1 1/4" for vent pipe
d. Requires a trap connection to the waste pipe
e. Requires a water fitting to deliver water to the nozzle
f. Has vacuum breaker on water supply

_____24.
a. Rated at 2 DFU
b. Requires a minimum of 1 1/2" for drain pipe
c. Requires a minimum of 1 1/2" for vent pipe
d. Requires a water fitting to deliver water to the sink
e. Requires a trap connection to the waste pipe

_____25.
a. Rated at 2 DFU
b. Usually installed directly below kitchen sink in place of the basket strainer
c. Requires a trap connection to the waste pipe.
d. Requires kitchen sink water supply to provide adequate flushing of the drain
e. Requires electrical connection

_____26.
a. Most common fuels are gas and electricity
b. Usually constructed to heat and store water
c. Usually constructed so the controls operate automatically

_____27.
a. Rated at 6 DFU
b. Requires a minimum of 3" for drain pipe
c. Requires a minimum of 2" for vent pipe
d. Has trap as an integral part of the fixture
e. Has a built-in flushing device

_____28.
a. Rated at 1 DFU
b. Requires a minimum of 1. 1/4" for drain pipe
c. Requires a minimum of 1 1/4" for vent pipe
d. Requires a trap connection to the waste pipe
e. Requires a water fitting to deliver water into the lavatory

_____29. a. Rated at 2 DFU
b. Requires a minimum of 2" for drain pipe
c. Requires a minimum of 1 1/2" for vent pipe
d. Requires a trap connection to the waste pipe
e. Requires a water fitting to deliver water to the shower bath

_____30. a. Rated at 2 DFU
b. Requires a minimum of 1 1/2" for drain pipe
c. Requires a minimum of 1 1/2" for vent pipe
d. Requires a trap and overflow connection to the waste pipe
e. Requires a water fitting to deliver water into the tub

_____31. a. Rated at 2 DFU
b. Requires a minimum of 1 1/2" for drain pipe
c. Requires a minimum of 1 1/4" for vent pipe
d. Requires a trap connection to the waste pipe
e. Requires a water fitting to deliver water to the laundry trays

_____32. a. Rated at 2 DFU
b. Requires a minimum of 1 1/2" for drain pipe
c. Requires a minimum of 1 1/4" for vent pipe
d. Most use a built-in pump to discharge waste water
e. Most have a built-in automatic water controllers
f. Requires a trap connection to the waste pipe or disposer

Part 3. Place a "T" in the blank beside true statements about the construction and materials used in the manufacture of fixtures and appliances. Place an "F" beside false statements.

_____33. Water closets are generally made in two sections--bowl and tank

_____34. Water closet tanks are not equipped with separately installed flushing mechanisms

_____35. Water closets are glazed and fired in a kiln at high heat for up to three days to ensure strength and quality of finish

_____36. Lavatories can be made from vitreous china, enameled cast iron, plastic, and fiberglass

_____37. Bath bottoms should have a 1/2" per foot pitch toward the drain

_____38. Shower baths are usually made of vitreous china

_____39. Shower baths are available in sizes of 30" x 30", 36" x 36", and 36" x 48"

_____40. Bidets are installed directly on the floor similar to a floor mounted water closet

_____41. Kitchen sinks are only available in single wells

_____42. Most water heaters are steel tanks with bonded glass linings intended to prevent corrosion of the tank

_____43. Water heaters are constructed with five pipe openings in the top

_____44. Black iron pipe and fittings should be used for the gas piping in gas water heaters

_____45. Water heaters are constructed with drain valves (boiler drains) at the bottom of the water tank

_____46. The electrical work for an electric water heater should be done by the plumber

_____47. Some electric water heaters have two heating elements

_____48. The four main components of a garbage disposer are the electric motor, grinding chamber, two grinding elements, and the sink fitting

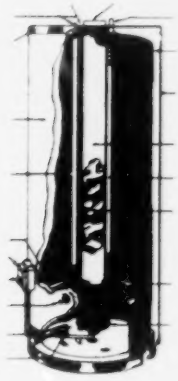
_____49. Most disposers do not have a dishwasher drain connection

_____50. Dishwashers are available in self contained units which need water and waste connections

_____51. Most laundry trays are made of fiberglass, cast iron, wood

_____52. Double compartment and single compartment laundry trays are available

Part 4. **Identify common fixtures and appliances used in residential plumbing.**



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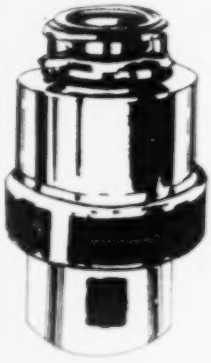
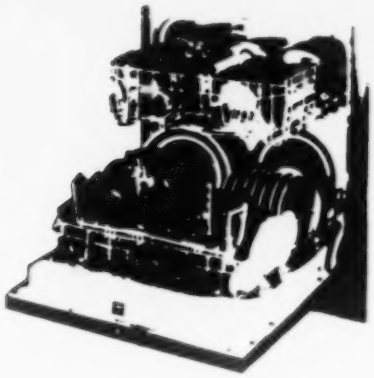


54. _____

55. _____

56. _____



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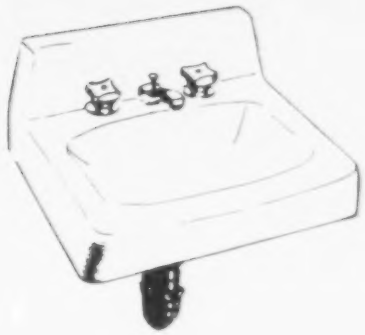

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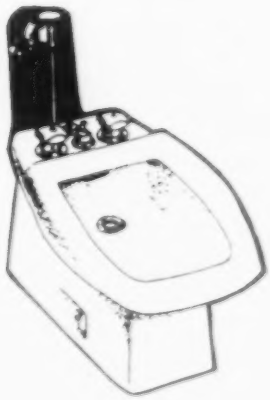
60. _____



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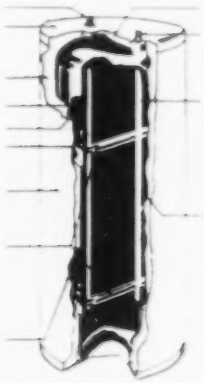

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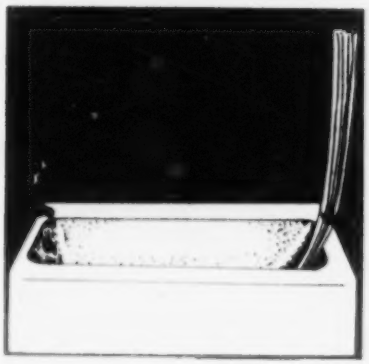

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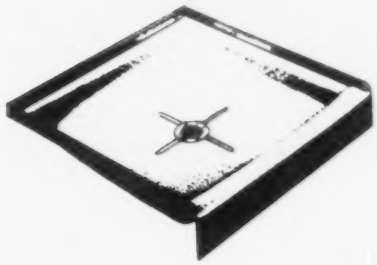

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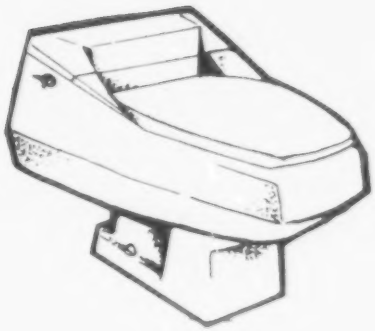

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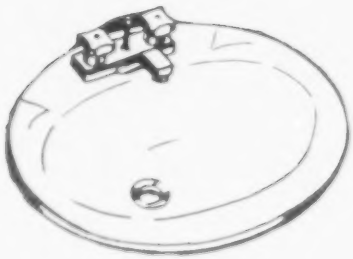

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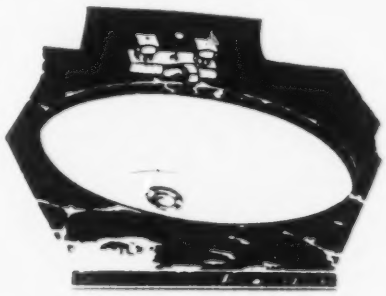

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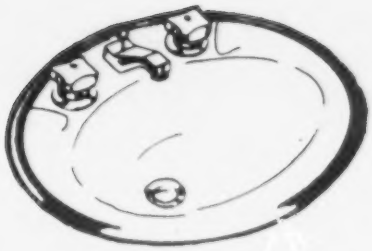

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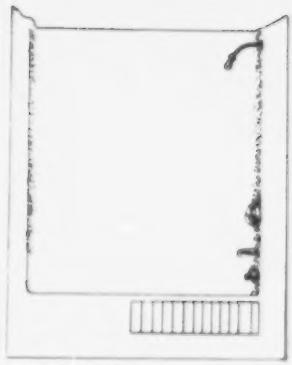

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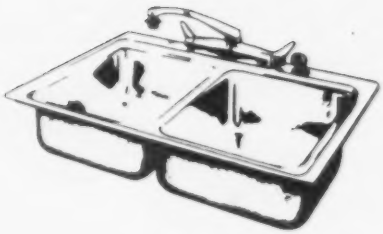

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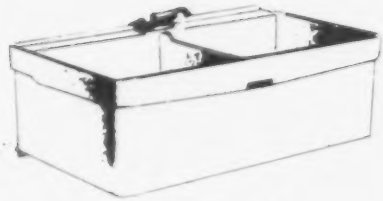


72. _____

MODULE: PLUMBING PROCEDURES

ANSWERS TO UNIT I, LESSON 4 TEST

Part 1A.

1.	C	4.	B	7.	BC	10.	D
2.	AC	5.	E	8.	A	11.	BD
3.	AE	6.	AB	9.	AD		

Part 1B.

12.	D	15.	AB	18.	B	21.	C
13.	AD	16.	BC	19.	AE	22.	BD
14.	A	17.	AC	20.	E		

Part 2.

23.	E	25.	AD	27.	A	29.	D	31.	BC
24.	AB	26.	AC	28.	B	30.	C	32.	AE

Part 3.

33.	T	38.	F	43.	F	48.	T
34.	F	39.	T	44.	T	49.	F
35.	T	40.	T	45.	T	50.	T
36.	T	41.	F	46.	F	51.	F
37.	F	42.	T	47.	T	52.	T

Part 4.

53. Gas water heater
54. Garbage disposer
55. One piece fiberglass shower enclosure
56. Floor model laundry tray
57. Dishwasher
58. Wall hung lavatory with raised back
59. Self-rimming kitchen sink
60. Floor set water closet with close coupled tank and bowl
61. Bidet
62. Electric water heater
63. Recessed bathtub
64. Shower base
65. One piece floor set tank and bowl combination water closet
66. Wall-hung siphon jet water closet with close-coupled tank and bowl
67. Self-rimming vanity lavatory
68. Under-counter vanity lavatory
69. Rim type vanity lavatory
70. Bath shower module
71. Rim-type kitchen sink
72. Wall hung laundry tray

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 5: MAINTENANCE AND REPAIR

LESSON OBJECTIVE

After completion of this lesson, the student will be able to REPAIR/REPLACE FAUCETS AND VALVES, and to LOCATE AND REPAIR LEAKS. Mastery will be evidenced by correctly performing the procedures outlined in the job sheets and by scoring _____ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms associated with maintenance and repair to the correct definitions or descriptions.
2. Describe emergency repair methods for fixing leaking pipes.
3. Match water closet tank malfunctions and their causes to correct remedies for those malfunctions.
4. Repair a leaking water faucet or valve.
5. Repair a leaking shower valve.
6. Repair a ball cock on a water closet.

Completion of the requirements of this lesson fulfills competencies C-9 and C-10 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 5: MAINTENANCE AND REPAIR

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Emergency water pipe repairs
   2. Water closet tank
   3. Ball cocks
   4. Ball valve

D. Job sheets
   1. Repair a leaking water faucet or valve
   2. Repair a leaking shower valve
   3. Repair a ball cock on a water closet

E. Lesson test

F. Answers to lesson test

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 5: MAINTENANCE AND REPAIR

INFORMATION OUTLINE

I. Terms and definitions

A. Maintenance--keeping equipment and plumbing systems functioning in an approved manner

B. Repair--to remedy or restore that which is broken or in unworkable condition

C. Malfunction--failure to operate in a normal or usual manner

II. Emergency repair methods for fixing leaking pipes (TM 1)

(Note: Emergency repairs are strictly temporary)

A. Rubber hose method
1. Turn off the water supply
2. Cut the defective section of pipe at the leak
3. Slip a small section of hose over the one end and line up pipes evenly

(Note: Inside diameter of hose must be nearly the same as outside diameter of defective pipe)

4. Slide hose half way over the other cut end
5. Fasten hose tightly with hose clamps

B. Sheet metal clamps method
1. Turn off the water supply
2. Wrap the leaky area with sheet rubber
3. Place sheet metal clamps, one on either side of the pipe, on the sheet rubber covering
4. Fasten the clamps with bolts and nuts

(Note: Clamps can be purchased from plumbing supply houses or they can be made from scrap sheet metal)

C. C-clamp method
   1. Turn off the water supply
   2. Cut a small piece of sheet rubber and place on the defective part of the pipe
   3. Place a small wooden block on the rubber sheet
   4. Place C-clamp in position and tighten against wooden block to hold sheet rubber on pipe

   (Note: A hose clamp can also be used in some cases)

III. Water closet tank malfunctions and their causes and remedies (TM 2, TM 3, TM 4)

A. Water continues to flow, draining into overflow tube due to float rising too high in tank
   1. Make sure float is clear of tank sides and is not held in a high position by bending float arm
   2. Make sure float does not rise above desired water level by bending float arm until desired level is achieved

   (Note: Use both hands to bend float arm as the ball cock can be damaged by excessive strain on the float arm connection)

B. Water continues to flow, draining through tank ball valve due to worn or deformed tank ball
   1. Clean existing ball and wipe valve seat clean
   2. If valve continues to leak, replace tank ball

C. Tank ball assembly fails to reseat ball valve due to misalignment
   1. Make sure lift rods are straight and aligned over ball valve
   2. Make sure trip lever is aligned over the ball valve
   3. Make sure rod guide is aligned over ball valve

D. Water continues to flow after float rises to normal shut-off position due to leaking ball cock valve
   1. Check linkage of float arm lever and valve plunger for defects which prevent valve closing

   (Note: Some water corrodes brass parts)

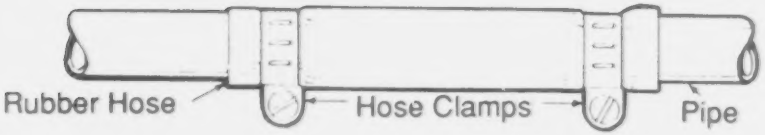
   2. Replace valve washer

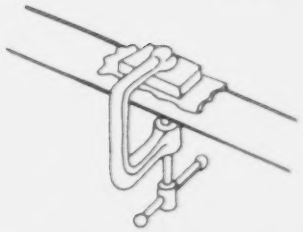
E. Water continues to flow, draining into base of overflow tube due to corrosion of threaded end of overflow tube
   1. Remove overflow tube and clean broken threads from tube base
   2. Install new overflow tube

      (Note: Measure and cut to correct length before installing)

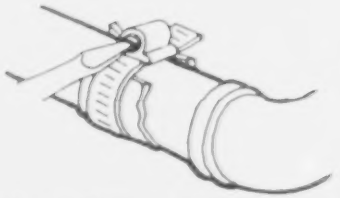
F. Water continues to flow as float does not rise due to being water logged
   1. Remove float and make repairs
   2. Remove float and replace with new float

Emergency Water Pipe Repairs

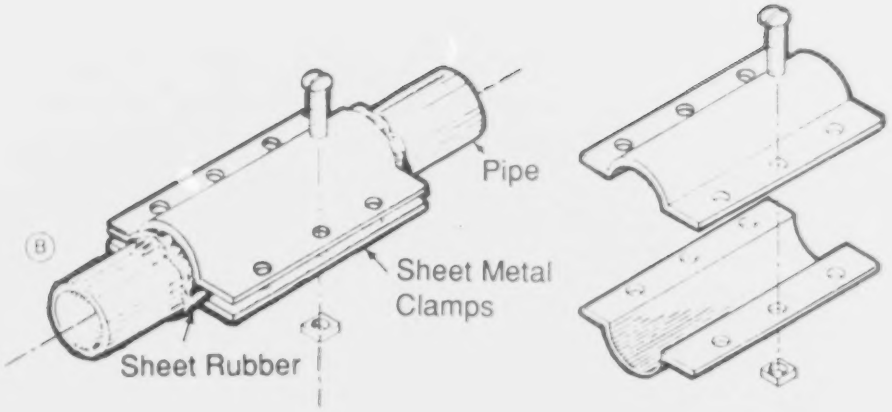




C-Clamp and
Block of Wood

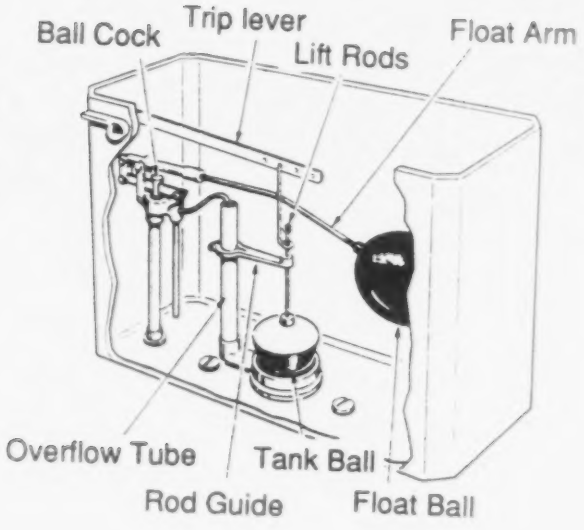


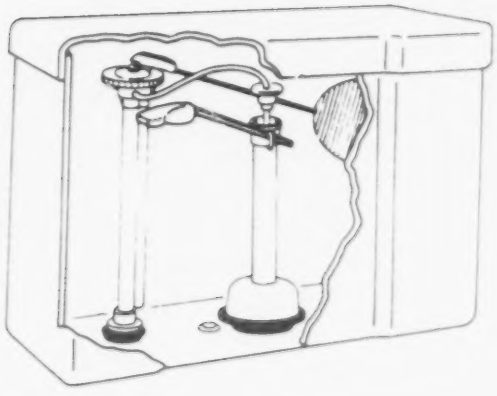
Hose Clamp (size 16 or 12)
and Rubber Blanket



PP 185

Water Closet Tank





Plastic Tank and Controls

Illustration provided by Mansfield Sanitary, Incorporated of Perrysville, Ohio, a subsidiary of Interpace Corporation.

Ball Cocks

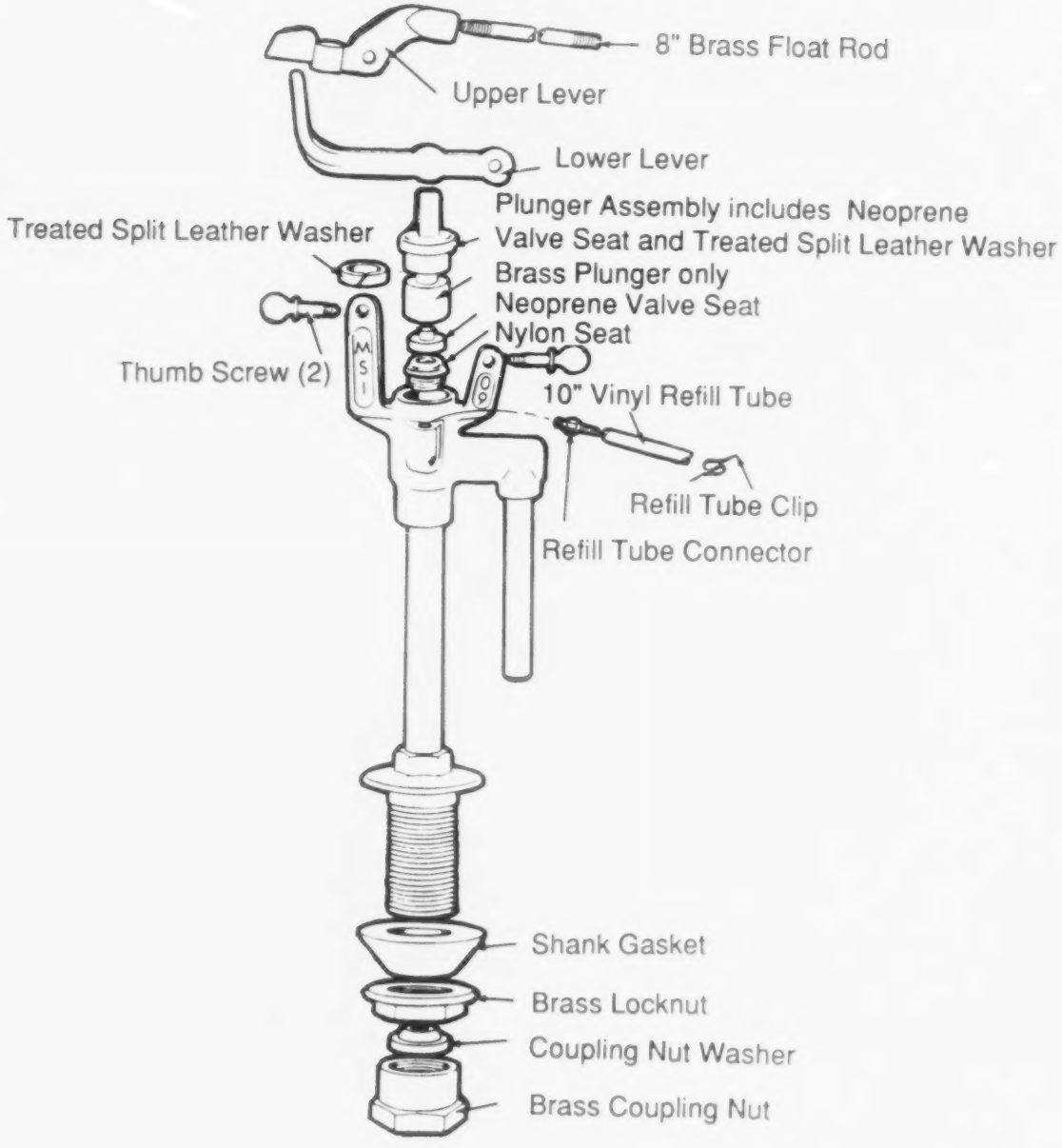


Illustration provided by Mansfield Sanitary, Incorporated of Perrysville, Ohio, a subsidiary of Interpace Corporation.

PP 189

Ball Valve

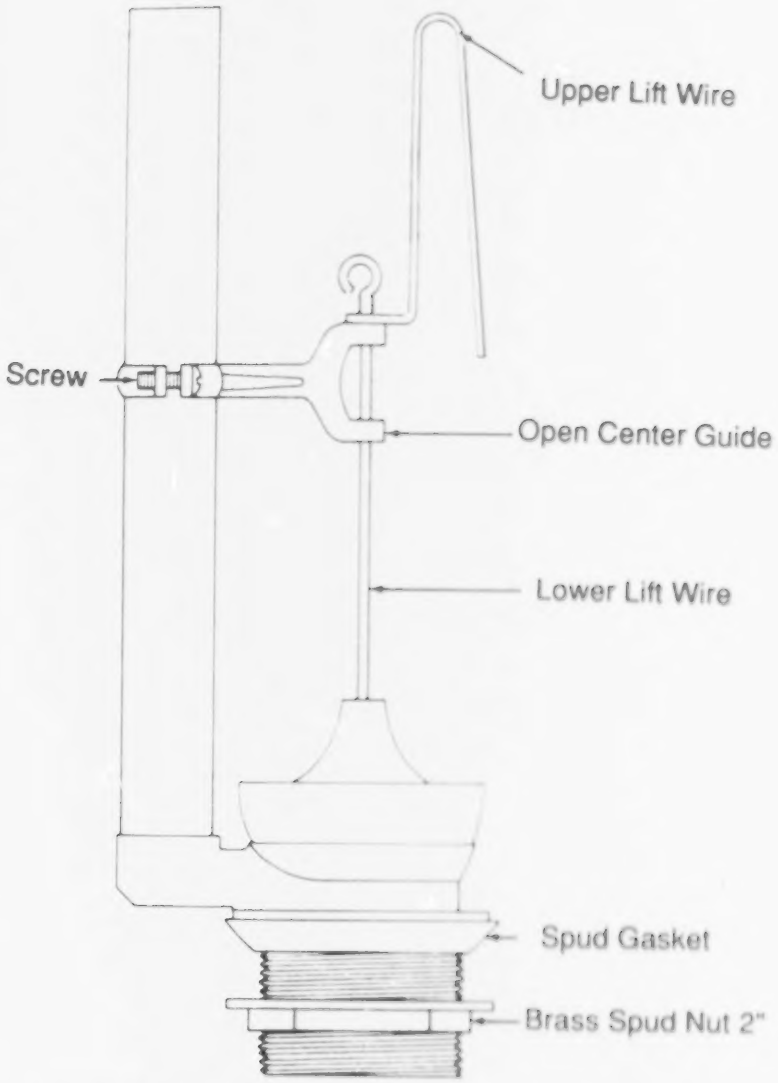


Illustration provided by Mansfield Sanitary, Incorporated of Perrysville, Ohio, a subsidiary of Interpace Corporation.

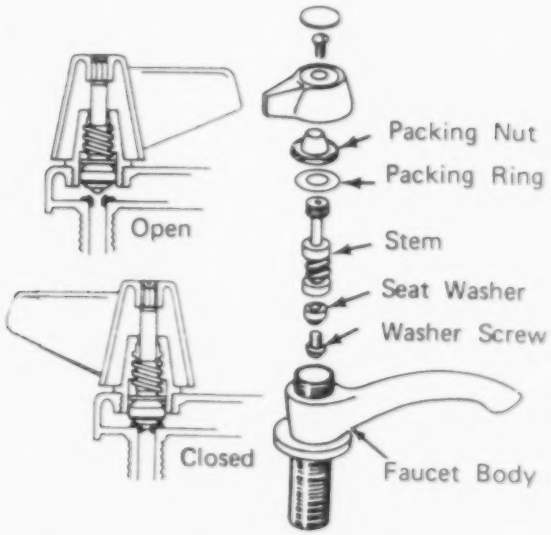
REPAIR A LEAKING WATER FAUCET OR VALVE

Equipment:

Strap wrench
Screwdriver
Compression type faucet
Adjustable wrench
Knife
Washers
Seat-dressing tool
Packing ring
Handle puller
Stem grease
Safety glasses

Procedure:

Evaluation
3 2 1 N



Used with permission from Goodheart-Willcox Company, South Holland, Illinois from *Modern Plumbing* by E. Keith Blankenbaker

1. Shut off water supply to faucet. _ _ _ _
2. Turn faucet handle to open faucet and remove handle. _ _ _ _
3. Remove packing nut using adjustable wrench. _ _ _
4. Remove spindle to expose washer. _ _ _ _
5. Check seat for wear. _ _ _ _

6. Inspect stem for wear. _ _ _ _

7. Remove brass washer screw with screwdriver. _ _ _ _

8. Lift washer with knife tip. _ _ _ _

9. Replace washer with new one and tighten with screwdriver. _ _ _ _

10. Replace packing ring between cap nut and spindle as follows:

    a. Remove cap nut and spindle. _ _ _ _

    b. Remove handle from top of stem. _ _ _ _

    c. Replace packing ring. _ _ _ _

11. Dress faucet ground seat as follows:

    a. Insert seat-dressing tool in faucet, and press threaded cone down into body opening. _ _ _ _

    b. Center spindle and cutter in faucet. _ _ _ _

    c. Using moderate downward pressure, rotate handwheel to the right to dress seat. _ _ _ _

    (Note: Seat should be clean and free from burrs and nicks when dressed.)

12. Reassemble remaining parts. _ _ _ _

    (Note: Apply stem grease to stem.)

13. Have instructor check your work. _ _ _ _

14. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. _ _ _ _

Average of above evaluations* _ _ _ _

*This average is the student's partial evaluation for competency C-9.

REPAIR A LEAKING SHOWER VALVE

Equipment:

Adjustable wrench
Screwdrivers
Plumber's socket wrench set
Valve seat wrench
Valve seat (new)
Washer (new)
Pipe compound
Clean cloth
Knife
Handle puller
Stem grease
Safety glasses

Procedure:

		Evaluation 3	2	1	N
1.	Cut off water supply to valve.	__	__	__	__
2.	Remove valve handle with handle puller	__	__	__	__
3.	Remove escutcheon.	__	__	__	__
4.	Loosen valve bonnet with socket wrench and remove valve stem assembly.	__	__	__	__
5.	Remove and replace valve seat, using valve-seat wrench.	__	__	__	__
6.	Remove washer on end of stem using knife tip.	__	__	__	__
7.	Replace washer using screwdriver.	__	__	__	__
8.	Reassemble valve using pipe compound to lubricate threads.	__	__	__	
9.	Tighten packing nut using adjustable wrench.	__	__	__	__
	(NOTE: Apply stem grease to stem.)				
10.	Replace escutcheon and valve handle.	__	__	__	__
11.	Wipe valve and adjacent area with clean cloth.	__	__	__	__
12.	Have instructor check your work.	__	__	__	__
13.	As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.	__	__	__	__
	Average of above evaluations*	__	__	__	__

***This average is the student's partial evaluation for competency C-9 of Building Maintenance.**

REPAIR A BALL COCK ON A WATER CLOSET

Equipment:

Water closet (tank type)	New ball cock
Screwdrivers	Pipe compound
Adjustable wrench	Clean cloth
Spud wrench or all-purpose wrench	Sponge
Vise-grip pliers	Safety glasses

Procedure:	Evaluation 3	2	1	N
1. Shut off water at fixture stop valve.				
2. Remove top from tank.				
3. Completely drain the tank and sponge out the water that does not drain.				
4. Remove the nut from underside of closet tank which holds ball cock and lift flush valve from tank.				
5. Remove diaphragm and rubber seat from guide.				
6. If worn, replace diaphragm, plunger, and seat washer.				
7. If worn, replace diaphragm guide.				
8. Replace ball cock if above steps are inappropriate.				
9. Replace tank top.				
10. Turn water on.				
11. Check operation of ball cock.				
12. Have instructor check your work.				
13. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.				
Average of above evaluations*				

*This average is the student's partial evaluation for competency C-9 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 5: MAINTENANCE AND REPAIR

LESSON TEST

Part 1. Match the terms below to the correct definitions or descriptions.

A. Repair
B. Malfunction
C. Maintenance

_____1. Keeping equipment and plumbing systems functioning in an approved manner

_____2. To remedy or restore that which is broken or in unworkable condition

_____3. Failure to operate in a normal or usual manner

Part 2. Match water closet tank malfunctions and causes below to their remedies.

A. Tank ball assembly fails to reseat ball valve due to misalignment
B. Water continues to flow, draining through tank ball valve due to worn or deformed tank ball
C. Water continues to flow, draining into base of overflow tube due to corrosion of threaded end of overflow tube
D. Water continues to flow, draining into overflow tube due to float rising too high in tank
E. Water continues to flow after float rises to normal shut-off position due to leaking ball cock valve

_____4. a. Make sure float is clear of tank sides and is not held in a high position by bending float arm
b. Make sure float does not rise above desired water level by bending float arm until desired level is achieved

_____5. a. Clean existing ball and wipe valve seat clean
b. If valve continues to leak, replace tank ball

_____6. a. Make sure lift rods are straight and aligned over ball valve
b. Make sure trip lever is aligned over the ball valve
c. Make sure rod guide is aligned over the ball valve

_____7. a. Check linkage of float arm lever and valve plunger for defects which prevent valve closing
b. Replace valve washer

_____8. a. Remove overflow tube and clean broken threads from tube base
b. Install new overflow tube

Part 3. Describe two emergency repair methods for fixing leaking pipes.

9.

10.

MODULE: PLUMBING PROCEDURES

ANSWERS TO UNIT I, LESSON 5 TEST

Part 1.

1. C
2. A
3. B

Part 2.

4. D
5. B
6. A
7. E
8. C

Part 3. (9-10) Description should include any two of the following applications:

Rubber hose

a. Turn off the water supply
b. Cut the defective section of pipe at the leak
c. Slip a small section of hose over the one end and line up pipes evenly
d. Slide hose half way over the other cut end
e. Fasten hose tightly with hose clamps

Sheet metal clamps

a. Turn off the water supply
b. Wrap the leaky area with sheet rubber
c. Place sheet metal clamps, one on either side of the pipe, on the sheet rubber covering
d. Fasten the clamps with bolts and nuts

C-clamp

a. Turn off the water supply
b. Cut a small piece of sheet rubber and place on the defective part of the pipe
c. Place a small wooden block on the rubber sheet
d. Place C-clamp in position and tighten against wooden block to hold sheet rubber on pipe

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 6: DRAINAGE SYSTEMS

LESSON OBJECTIVE

After completion of this lesson, the student will be able to MATCH TERMS ASSOCIATED WITH MAINTENANCE AND REPAIR OF DRAINAGE SYSTEMS TO CORRECT DEFINITIONS OR DESCRIPTIONS, IDENTIFY EQUIPMENT USED TO CLEAR STOPPAGES IN PLUMBING FIXTURES, IDENTIFY CLEAN-OUT ACCESS POINTS IN A DRAINAGE SYSTEM, AND DEMONSTRATE THE ABILITY TO REMOVE OBSTRUCTIONS FROM DRAIN LINES. Mastery will be evidenced by correctly performing the procedures outlined on the job sheets and by scoring _____ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms associated with maintenance and repair of drainage systems to the correct definitions and descriptions.
2. Identify equipment used to clear stoppages in plumbing fixtures.
3. Identify clean-out access points in a drainage system.
4. Replace a lavatory trap.
5. Clear obstructions from a lavatory drain.
6. Clear obstructions from a water closet drain.
7. Clear obstructions from a main drain line.

Completion of the requirements of this lesson fulfills competency C-11 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 6: DRAINAGE SYSTEMS

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Equipment to clear stoppages
   2. Clean-out access points
   3. Clean-out access points (continued)

D. Job sheets
   1. Replace a lavatory trap
   2. Clear obstructions from a lavatory drain
   3. Clear obstructions from a water closet drain
   4. Clear obstruction from a main drain line

E. Lesson test

F. Answers to lesson test

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 6: DRAINAGE SYSTEMS

INFORMATION OUTLINE

I. Terms and definitions

A. Caustic chemicals--chemicals, either in liquid or powder form, used to dissolve soap, grease, and other accumulations in drain pipe

B. Auger--rotary tool used by plumbers to clean drains

C. Plumber's friend--plunger used to help clear fixture drains, saving the plumber from messy work

D. Snake--steel band or spring coiled up for easy use, used to clear plumbing drains

II. Equipment used to clear stoppages in plumbing fixtures (TM 1)

(Note: Check for acid or any other corrosive substance before working on drains)

A. Plunger

(Note: A plunger is also known as the plumber's friend--and as a force cup)

B. Closet auger

(Note: After using, wash with clean water and oil to avoid rusting)

C. Trap and drain auger

(Note: The trap and drain auger is best used on waste pipes and traps that are not easily disassembled)

D. Water ram

(Note: Use the water ram with care as this tool can blow water out of other fixture traps)

E. Plumber's snake

(Note: Plumber's snakes are either electric or manual--small snakes may help to loosen stoppages in lavatory and kitchen sink traps, but the best solution is to remove and clean the trap)

F. Caustic chemicals

(CAUTION: Use caustic chemicals only as a last resort, especially to remove grease and soap buildup in drain lines--do not use in plastic pipes)

III. Clean-out access point on a drainage system (TM 2 and 3)

(Note: Check local codes)

A. Base of stack

(Note: Many codes require a clean-out at the base of each vertical drain pipe)

B. Traps

(Note: Lavatory, kitchen sink, and exposed bath and shower traps should be made to be easily removed)

C. Vent terminals

(Note: These are specifically intended for clearing blocked stacks)

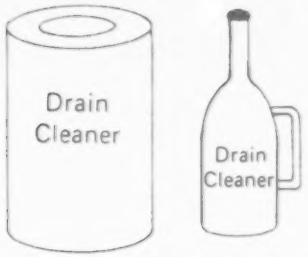
D. Clean-outs in sewer line

(Note: Check the local codes--many codes require buried sewer lines to have a clean-out for every 50' of pipe)

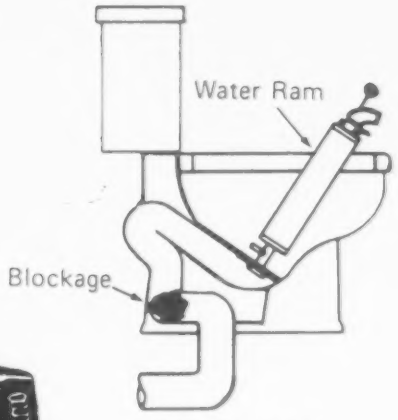
E. Water closets

(Note: Remove water closet for drain cleaning only after all other attempts have been made)

Equipment to Clear Stoppages



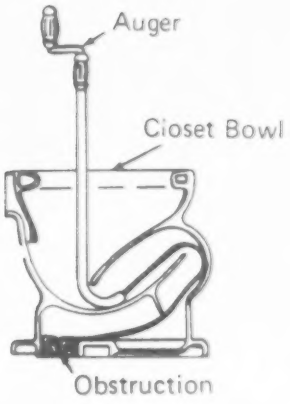
Caustic Chemicals



Water Ram

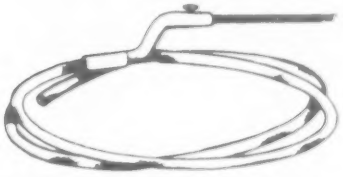
Portable
Electric Snake

Plunger



Closet Auger in use

Plumber's Snake

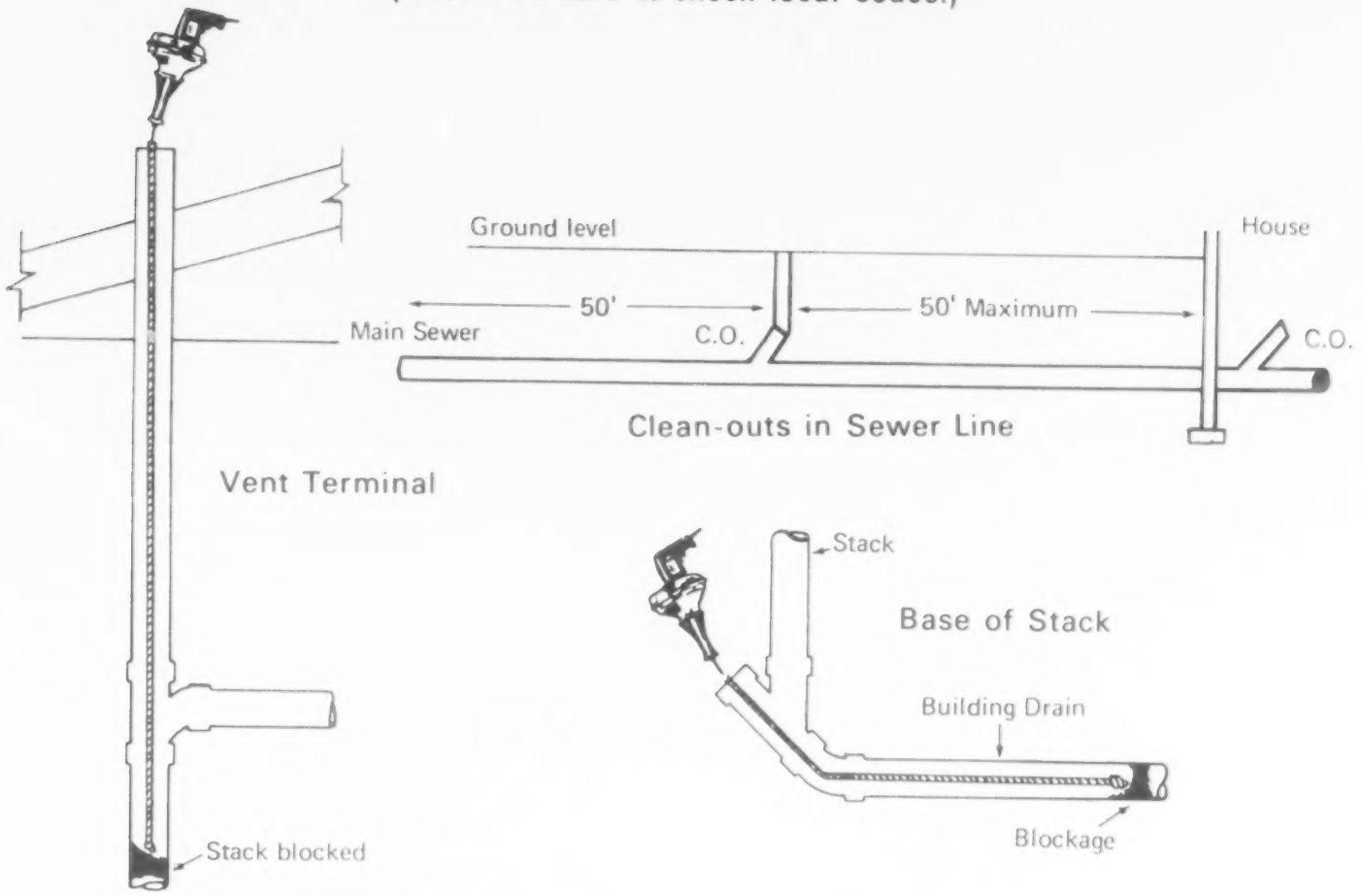


Trap and Drain Auger

Used with permission from Goodheart-Willcox Company, South Holland, Illinois from *Modern Plumbing* by E. Keith Blankenbaker

Clean-out Access Points

(Note: Be sure to check local codes.)



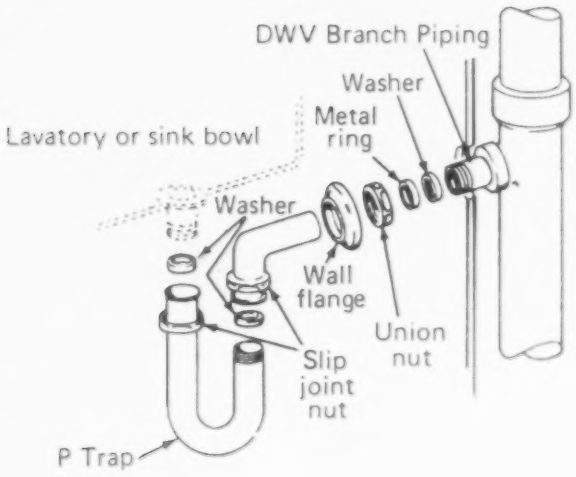
Used with permission from Goodheart-Willcox Company, South Holland, Illinois from *Modern Plumbing* by E. Keith Blankenbaker

PP 211

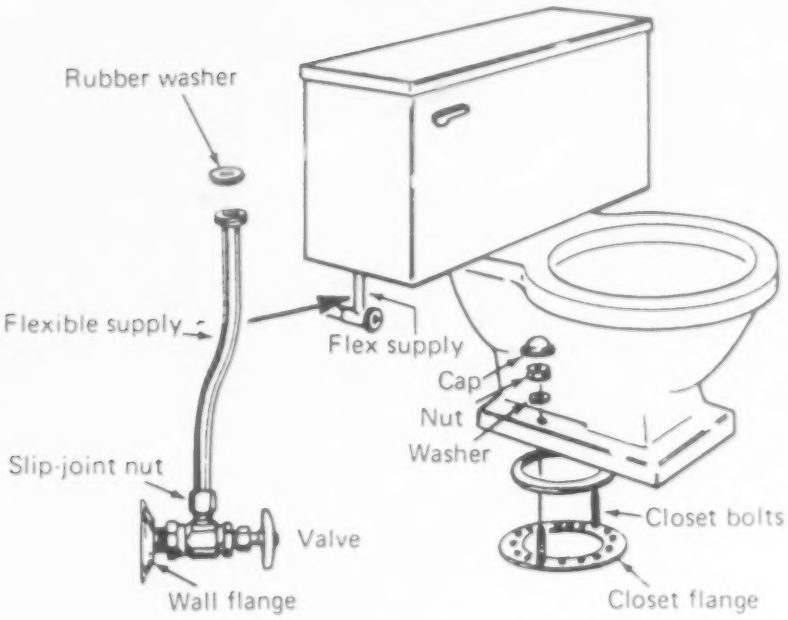
TM 2

Clean-out Access Points (Continued)

P-trap



Water Closet



REPLACE A LAVATORY TRAP

Equipment:

Lavatory with P trap
Adjustable wrench or all-purpose wrench
Pan to catch trap water
New trap with washers and slip nuts
Pipe compound
Drop cloth
Safety glasses

Procedure:	Evaluation 3	2	1	N
1. Spread drop cloth under lavatory.	—	—	—	–
2. Disconnect slip-joint nuts at lavatory trap.	—	—	—	–
(Note: Use a pan to catch trap water.)				
3. Replace lavatory trap, using complete kit provided by manufacturer and other necessary materials.	—	—	—	–
4. Check for leaks.	—	—	—	–
5. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.	—	—	—	–
Average of above evaluations*	—	—	—	–

*This average is the student's partial evaluation for competency C-11.

CLEAR OBSTRUCTIONS FROM A LAVATORY DRAIN

Equipment:

Lavatory with P trap
Adjustable wrench
All-purpose wrench
Cloth
Plunger
Flexible cable with auger
Caustic chemical
Clean rag
Pipe compound
Safety glass

Procedure:	Evaluation 3 2 1 N
1. Remove clean-out or drain stopper and check for obstruction.	___ ___ ___ ___
2. Remove any obstruction and check for proper drainage.	___ ___ ___ ___
3. If problem is not solved, plug overflow with rag, and force air and water through drain line with a vacuum plunger.	___ ___ ___ ___
4. If problem is not solved, rod out drain line with flexible cable and auger.	___ ___ ___ ___
5. If limited amount of water is moving, pour caustic chemical into drain, using chemical manufacturer's instructions for proper application.	___ ___ ___ ___
6. If problem still exists, disassemble, clean, and reassemble drain and P-trap.	___ ___ ___ ___
7. Have instructor check your work.	___ ___ ___ ___
8. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.	___ ___ ___ ___
Average of above evaluations*	___ ___ ___ ___

*This average is the student's partial evaluation for competency C-11.

CLEAR OBSTRUCTIONS FROM A WATER CLOSET DRAIN

Equipment:

Water closet connected to drain system
Plunger
Closet auger
Bucket
Safety glasses

Procedure	Evaluation 3	2	1	N
1. Remove cover from tank.				
2. Force water through the water closet drain, using a vacuum plunger.				
3. Flush water closet.				
(Note: Be prepared to stop water flow if necessary.)				
4. If problem still exists, rod out drain with flexible cable and auger.				
5. Remove auger from drain, pulling obstruction with auger.				
6. If obstruction cannot be dislodged with auger, disconnect water closet and remove obstruction from drain.				
7, Flush with handful of toilet tissue to test flushing action.				
8. Have instructor check your work.				
9. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.				
Average of above evaluations*				

*This average is the student's partial evaluation for competency C-11.

CLEAR OBSTRUCTION FROM A MAIN DRAIN LINE

Equipment:

Power sewer auger with attachments
Caustic chemical
Spud wrench or clean-out wrench
Heavy gloves (approved type)
Clean cloths
Safety glasses

Procedure	Evaluation 3	2	1	N
1. Identify clean-out opening in drain line; if none exists, remove appropriate fixture.				
2. Attach proper size bit on end of cable.				
3. Insert bit and cable into fixture drain line.				
4. Bend cable as required to reach obstruction.				
5. Activate power auger and clean line, removing and cleaning auger as necessary.				
6. Run water through line.				
7. Repeat process until line is cleaned.				
8. Replace fixture.				
9. Have instructor check your work.				
10. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.				
Average of above evaluations*				

*This average is the student's partial evaluation for competency C-11.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 6: DRAINAGE SYSTEMS

LESSON TEST

Part 1. Match the terms below to the correct definitions and descriptions.

A. Plumber's friend
B. Snake
C. Auger
D. Caustic chemicals

_____1. Chemicals, either in liquid or powder form, used to dissolve soap, grease, and other accumulations in drain pipe.

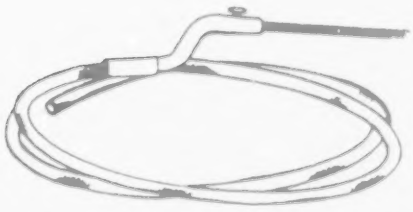
_____2. Rotary tool used by plumbers to clean drains

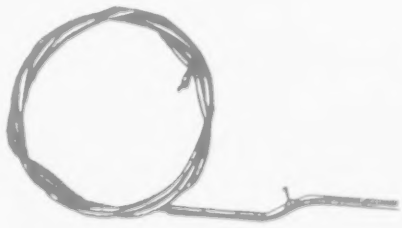
_____3. Plunger used to help clear fixture drains, saving the plumber from messy work

_____4. Steel band or spring coiled up for easy use, used to clear plumbing drains

Part 2. Identify equipment used to clear stoppages in plumbing fixtures by matching equipment with correct identity.

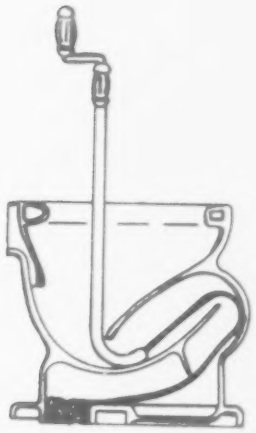
A. Plunger
B. Caustic chemicals
C. Plumber's snake
D. Trap and drain auger
E. Closet auger
AB. Water ram



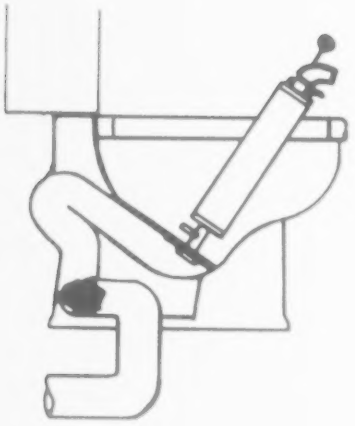


5. _____

6. _____



7. _____



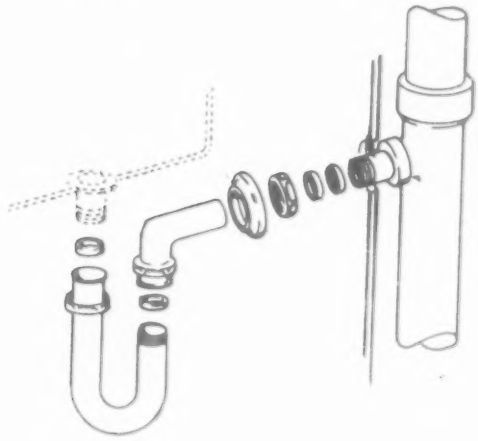
8. _____

9. _____

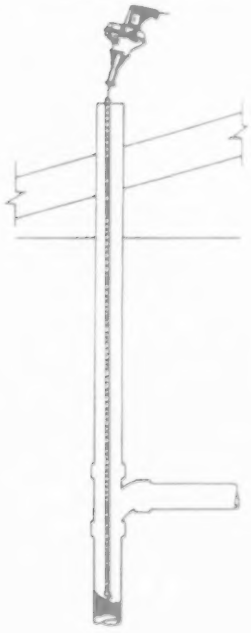
10. _____

Part 3. Identify clean-out access points on a drainage system by matching with identity.

A. Clean-outs in sewer line
B. Base of stack
C. Traps
D. Vent terminal
E. Water closet

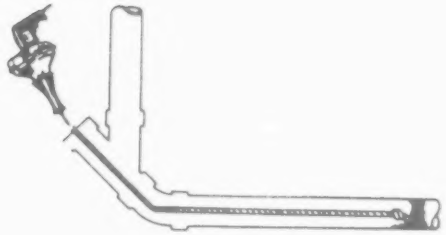


11._____

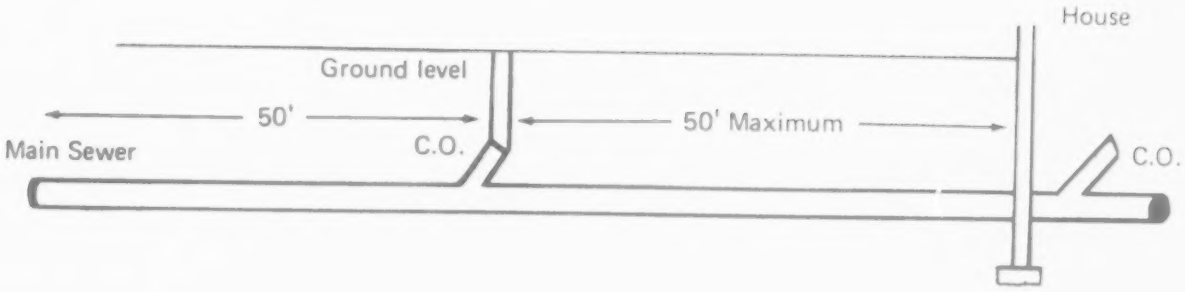


12._____

13._____



14. _____



15. _____

MODULE: PLUMBING PROCEDURES

ANSWERS TO UNIT I, LESSON 6 TEST

Part 1.

1. D
2. C
3. A
4. B

Part 2.

5. D
6. C
7. E
8. AB
9. B
10. A

Part 3.

11. C
12. D
13. E
14. B
15. A

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 7: CLEANING PLUMBING FIXTURES

LESSON OBJECTIVE

After completion of this lesson the student will be able to PROPERLY CLEAN AND SANITIZE PLUMBING FIXTURES. Mastery will be evidenced by correctly performing the procedures outlined on the job sheet.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Demonstrate the ability to clean and sanitize lavatory, commode, urinal, and drinking fountain.

Completion of the requirements of this lesson fulfills competency C-12 of Building Maintenance.

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 7: CLEANING PLUMBING FIXTURES

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Job sheet
   1. Clean and sanitize a plumbing fixture

MODULE: PLUMBING PROCEDURES

UNIT I: PLUMBING

LESSON 7: CLEANING PLUMBING FIXTURES

INFORMATION OUTLINE

I. Cleaning and sanitizing lavatories, stools, urinals, and drinking fountains must be performed daily to kill germs and odors which spread disease

II. Lavatories

A. Pour liquid detergent on exterior surfaces

B. Use sponge and spread detergent over entire surface including faucets and pipes beneath lavatory

C. Rinse lavatory, faucets, and pipes with clean water

D. Dry faucets and pipes with soft towel

E. Use scouring powder only on heavily pitted sinks and difficult stains

III. Commodes (stools)

A. Flush commode

B. Pour liquid detergent into stool

C. Use commode brush to clean inside of commode, top, and underside of the seat--pay special attention to underside of rim

D. Flush commode

E. Pour disinfectant into bowl--use brush and scrub entire surface of the bowl inside and out--including seat

F. Flush stool and rinse entire surface of stool with clean water

G. Wipe seat and exterior surface with clean sponge

H. Dry flush lever and pipes with soft towel

IV. Urinals

A. Flush urinal

B. Pour liquid detergent into urinal

C. Use brush to clean interior and exterior of urinal

D. Flush urinal

E. Pour disinfectant into urinal--use brush and scrub entire surface

F. Flush urinal and rinse entire surface with clean water

G. Dry flush lever and pipes with soft towel

V. Drinking fountains

A. Flush top of fountain with clean water

B. Use liquid detergent and sponge and wash fountain

C. Rinse fountain with clean water

D. Dry fountain with soft towel

E. Polish top of fountain with metal polish

F. Wipe polish off top of fountain with soft cloth

CLEAN AND SANITIZE A PLUMBING FIXTURE

Equipment:

Safety glasses
Liquid detergent
Disinfectant
Commode brush
Sponge
Soft cloth
Scouring powder

Procedure:	Evaluation 3	2	1	N
1. Flush fixture with clean water.				
2. Pour liquid detergent into fixture.				
3. Scrub fixture with brush.				
4. Flush fixture with clean water.				
5. Pour disinfectant into fixture.				
6. Scrub interior and exterior with brush.				
7. Flush with clean water.				
8. Use sponge and wipe exterior.				
9. Dry all metal with soft cloth.				
10. Use scouring powder only on badly pitted fixtures or difficult stains.				
11. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.				
Average of above evaluations*				

*This average is the student's evaluation for competency C-12 of Building Maintenance.